



DOING BUSINESS
HONDAJET TAKES
OFF WITH FRESH
DEALS AT LABACE
SHOW REPORT P24

POWERING UP
Embattled Bombardier
gets lift, as new engine
option adds thrust to
C-Series sales effort **11**

CRASH COURSE
Why NASA is destroying
Cessna 172s as means
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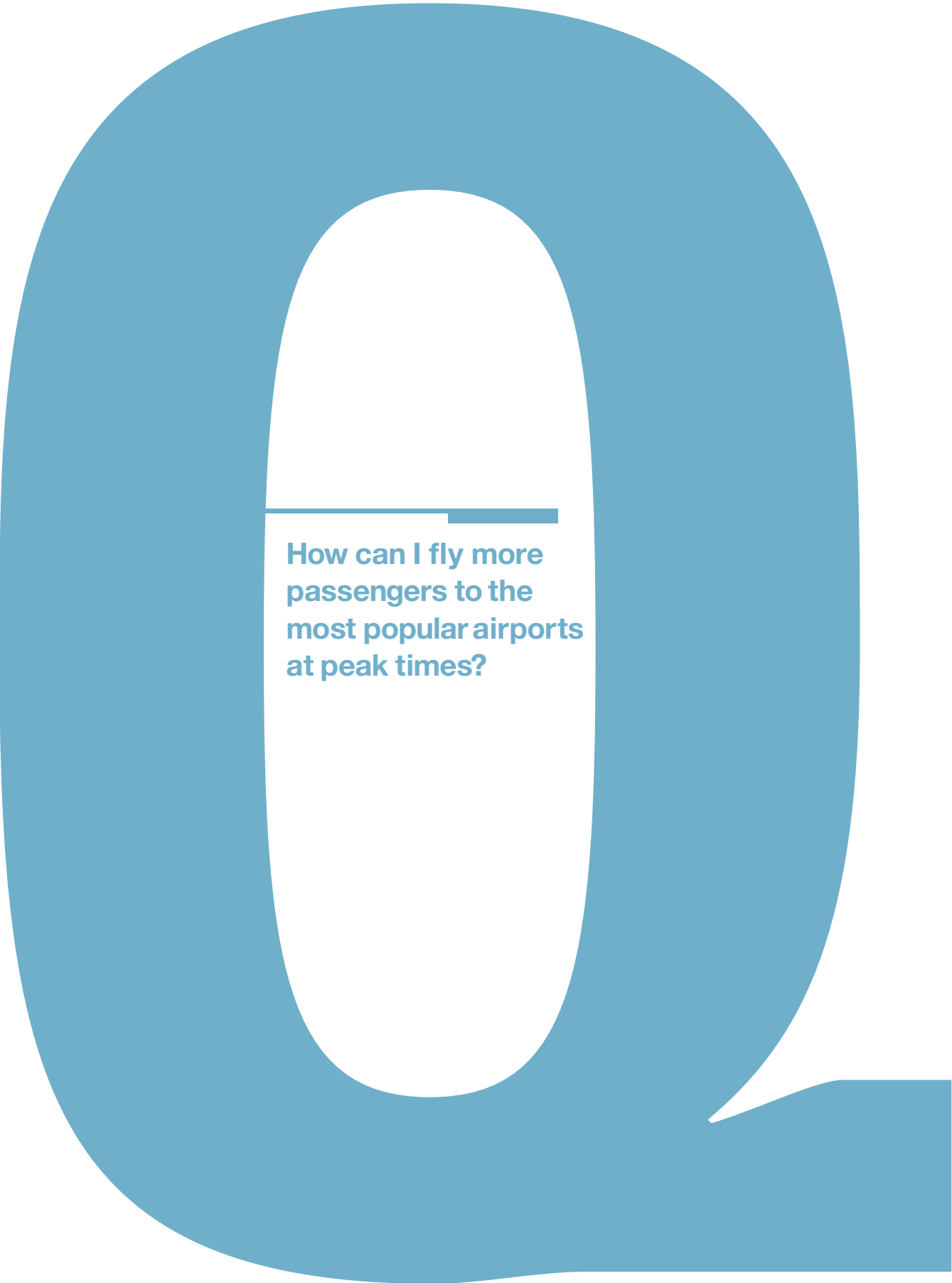
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place alongside global aerospace's elite

£3.50





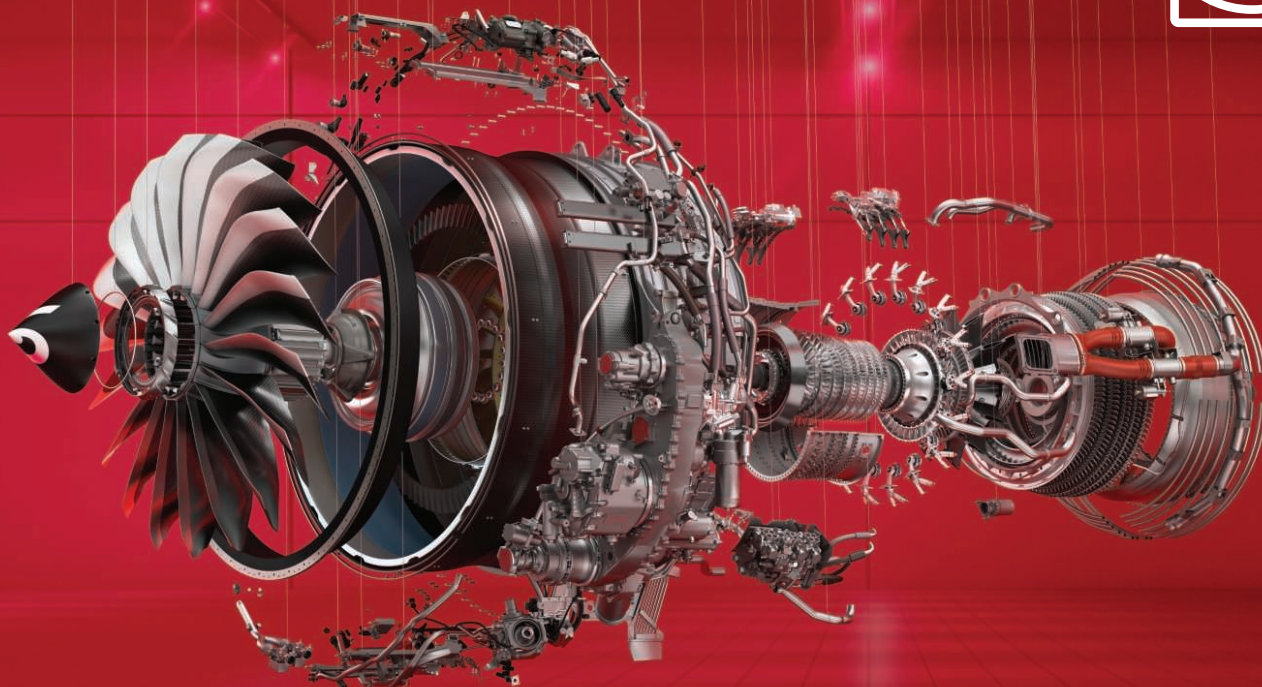
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LEAP

MORE TO BELIEVE IN



COVER IMAGE

Russia's MAKS air show is the main shop window for its diverse aerospace industry. Our preview of the event looks at Moscow's current challenges **P29**



BEHIND THE HEADLINES

Stephen Trimble travelled to Brazil's largest city, São Paulo, for Latin America's pre-eminent business aviation show, LABACE. Despite the economic turbulence sweeping the region, the event remains a magnet for the major airframers **(P24)**



NEXT ISSUE CONNECTIVITY

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Legacy 450 wins type certification approval **P24**. Crucial components of Irkut MC-21 wing box assembled **P15**



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IMAGE OF THE WEEK

Jetstar Airways, the low-cost division of Qantas, has revealed the first of five repainted Bombardier Dash 8 Q300s that will be used to launch regional services in New Zealand in late 2015. The aircraft – VH-TQM – was repainted from QantasLink colours to Jetstar's livery in Townsville, Queensland

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Jetstar Airways

THE WEEK IN NUMBERS

6%

Flightglobal dashboard

First half growth in world airline passenger traffic was led by 10% increases in Asia-Pacific and Latin America

\$45.8m

NASA

Value of a NASA contract to build ground structures to support SLS, the biggest-ever rocket, to fly from 2018

80

Flightglobal dashboard

Brazil's multi-billion dollar upgrade of 270 regional airports will kick off with four score located in the Amazon basin

QUESTION OF THE WEEK

Last week, we asked: **The US Marine Corps' IOC declaration for the F-35B?** You said:

49%

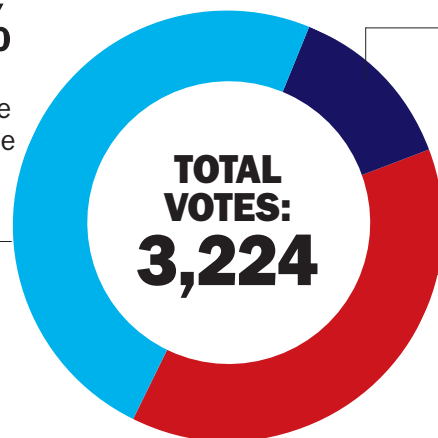
Shows how far the programme has come

13%

Important, but challenges remain

38%

Papering over the cracks



This week, we ask: **Russia's civil aerospace ambitions?**

- ☐ Will come good in the long term
- ☐ Only for domestic and client states
- ☐ Western aircraft will dominate

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Buffett's precise play

The Oracle of Omaha's mega-deal reminded everybody that aerospace is one of few industries today with a serious upside – but while investors are hungry, don't expect a feeding frenzy

In a world where the word “investor” all too often brings to mind derivatives, short-selling, deals-a-second computer algorithms and lunch hour spread trading, it is comforting to be reminded of the (hugely successful) existence of Warren Buffett.

The “Oracle of Omaha” and head of conglomerate Berkshire Hathaway has built a fortune by identifying companies with growth potential, buying them when prices are low, and holding them for the long term. Precision Castparts, a maker of forged, cast and machined components, is one such company.

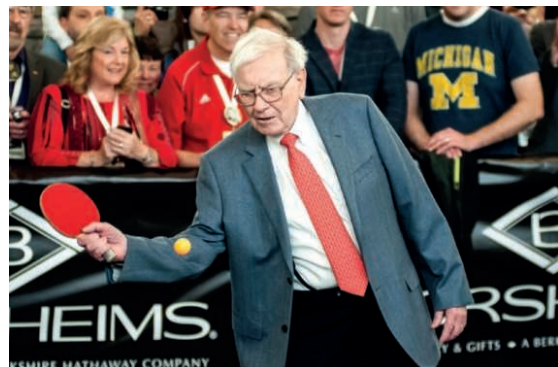
With its energy sector customers hit by falling oil prices, Precision's shares were trading in the mid-\$190s before Buffett swooped in to pay \$235, or \$32.5 billion for the whole company. Clearly, he reckons a premium of about a fifth is still good value, given the huge upside in the two-thirds of the company that serves aerospace. Expect Berkshire Hathaway to still be

Suppliers are more profitable than airframers, and airframers are vulnerable at the moment

owning Precision in 10, 20, maybe 30 years' time, when the airframers and engine makers it supplies will still be running full-tilt to equip new airliners.

But where Buffett may have scored a coup, the deal also highlights a not undisturbing aspect of the world today. Investors like Buffett are sitting on mountains of cash – some \$67 billion in Berkshire Hathaway's case, and are struggling to find profitable places to park it. In a fragile global economy, aerospace is one of the few industries with clear growth potential.

So, it is worth asking, why is there absolutely no



He keeps his eye on the ball

indication that Buffett, or any other financial investor, was ever seriously interested in Sikorsky?

When United Technologies sold the helicopter maker to Lockheed Martin for a measly \$8 billion last month, surely many investors thought they had missed a bargain? After all, low oil prices have hammered demand for offshore helicopters, and its military business is suffering in the US spending squeeze. This ought to have been a good time to invest in Sikorsky.

Or, not. One simple explanation is that suppliers are more profitable and less risky than airframers. Another is that many airframers are vulnerable now. China's recent currency manipulation is a sign that the world is heading not for recovery, but for uncertainty or worse.

Aviation may have emerged from the 2008 financial crisis as the investor's darling, but another downturn could kick off a wave of consolidation, which is a fancy way of saying that some companies will disappear. No investment firm wants to hold companies it can only sell at distressed prices. ■

See This Week P13

Moscow mewls

Two years ago, Russia's storied aerospace industry – much like the country itself – entered the 2013 MAKS air show near the crest of a wave of prosperity.

Then everything changed. Beginning with riots in Kiev, the annexation of Crimea, aggression in eastern Ukraine, economic sanctions, the shooting down of Malaysia Airlines flight MH17 and plummeting oil prices, Russia enters this year's MAKS event mired in an economic slump and marked as a global pariah.

Its aerospace industry is hardly faring better, despite increasing defence spending. Key modernisation programmes, including the stealthy PAK FA fighter and PAK DA bomber, have slowed dramatically. The star of Russia's commercial industry, the Sukhoi Superjet, got

a \$2 billion government bailout to avoid insolvency. The next great hope for commercial relevancy, the Irkut MC-21, looks behind schedule, and its heavily Western supply chain could be disrupted by sanctions.

How Russia's aerospace leadership responds to the situation will be critical for the industry's health. New United Aircraft chief executive Yuri Slyusar seems set on pivoting his supply chain to the East by developing internal system suppliers and relying more on China.

If so much can happen within two years, how could Russia's situation evolve before 2017? Bar a sudden change in political and economic strategy, it is difficult to see how further change could be an improvement. ■

See Russian Special P29



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BRIEFING

AIRBUS EVALUATES IMPACT OF TIANJIN BLASTS

MANUFACTURING Airbus is investigating the “potential impact” on component deliveries through the port of Tianjin to its nearby Chinese final assembly line, following a series of explosions in the coastal city on 12 August. Although its facility is located “far beyond” the radius of the blasts, the company is assessing possible supply chain disruption from any closure or restrictions at the port. Major aircraft assemblies are shipped from Airbus’s Hamburg plant to Tianjin, and then transported by road to the final assembly line.

STEEPER APPROACHES COULD HUSH HEATHROW

TRIAL London Heathrow airport is to conduct a six-month trial of slightly steeper glidepaths from 14 September, raising the approach angle from 3° to 3.2°. The test is part of an assessment that could ultimately involve approaches of 3.5°, supporting noise abatement.

JORDAN TO FIELD PILATUS TRAINERS

ORDER Pilatus will supply the Royal Jordanian Air Force with nine PC-9M turboprops to meet the service’s basic and advanced training requirements from January 2017. The deal also includes a flight simulator, associated training equipment and in-service support. Flightglobal’s Fleets Analyzer database lists the nation as currently operating 13 Airbus Defence & Space C-101 jet trainers.

TUI GROUP SETS SAVINGS TARGET

STRATEGY Tour operator TUI Group aims to save €50 million (\$55 million) by 2018-2019 through a strategic plan to explore common purchasing avenues for its five carriers. “We will act as one wherever it makes sense to do so, maintaining local differences where the benefit of that differentiation is greater than that of harmonisation,” TUI says. It has already enhanced its long-haul fleet with five Boeing 787-8s this year – bringing its total to 13 – and expects to receive four -9-model examples by the summer of 2019.

PLANS IN PLACE FOR SKYMARK SUPERJUMBOS

DELIVERIES Airbus Group has set a reallocation plan for a pair of undelivered A380s, chief financial officer Harald Wilhelm said during a first-half results briefing on 31 July, adding: “I would not wish to get more specific on this.” The airframer had assembled two A380s for Japanese carrier Skymark Airlines before it cancelled a six-unit order, leaving the superjumbos as ‘white tails’ in Toulouse. ANA, which is part of Skymark’s rescue plan, denies interest in taking the A380s.

IMPROVED ANTARES ROCKET TO FLY IN EARLY 2016

SPACEFLIGHT Orbital ATK reports “excellent progress” in resuming its NASA-contracted delivery flights to the International Space Station, following the 28 October 2014 explosion at Wallops Island, Virginia that destroyed one of its Antares rockets and Cygnus cargo capsules seconds after lift-off. Launch pad repairs should conclude in September, while an Antares rocket with upgraded RD-181 engines will replace the ill-fated AJ-26 and fly in “early 2016”. Meanwhile, a Cygnus spacecraft is set for launch by Atlas V rocket in December.

ISRAEL NEARS INFANTRY UAV CONTEST LAUNCH

REQUIREMENT Israel’s defence ministry will in the coming months issue a request for proposals to acquire a “personal” unmanned air vehicle to be carried by infantry soldiers within its battalion-level units. Israeli sources suggest that the micro-UAV design should weigh approximately 2kg (4.4lb) and have a 20-30min endurance.



The aircraft collided with parked cars beyond the runway’s end

INCIDENT DAVID KAMINSKI-MORROW LONDON

Bin Laden Phenom overran on landing

Saudi-registered jet landed long and crashed at Blackbushe after high-speed approach involving conflict with microlight

Investigators have determined that an Embraer Phenom 300 landed long and overran the runway at Blackbushe in the UK after an unstable high-speed approach that involved a conflict with a microlight.

The Saudi-registered jet (HZ-IBN) was two-thirds of the way down the 1,059m (3,470ft) runway 25 before it touched down, travelling at 134kt (248km/h).

UK Air Accidents Investigation Branch analysis indicates that the aircraft would have needed at least 616m to stop, but had landed with just 438m of paved surface remaining – of which only 349m was part of the declared available landing distance.

The aircraft overran and struck an earth bank, which sheared off the nose-gear, before the jet briefly became airborne and collided with several parked cars about 70m beyond the runway end.

None of the four occupants – a pilot and three passengers, members of the Bin Laden family – survived the impact and subsequent fire.

Investigators have released only preliminary information about the 31 July accident, but the data indicates that the aircraft

continued with a fast and unstable approach, at a high rate of descent, despite a series of ground-proximity warnings.

The initial inquiry found that the Phenom had encountered a microlight as it flew the downwind leg of the approach at about 1,000ft. It climbed slightly to overtake the microlight, and the crew received a collision-avoidance advisory ordering the Phenom to descend. The jet then descended at a rate of up to 3,000ft/min towards the threshold of runway 25.

Investigators have determined that the aircraft was still at 1,200ft while just 1.1nm from the threshold, far above a typical 3° glideslope. Its rapid descent meant it crossed the threshold at 50ft but still travelling at 150kt – more than 40kt above the calculated target airspeed of 108kt.

Six ground-proximity warnings, ordering the pilot to “pull up”, had been generated during the approach, but the pilot did not execute a missed approach.

Investigators are continuing with their analysis of the accident and have yet to reach any conclusions. The approach had been conducted in daylight and good weather. ■



'Budget realities'
could see US Navy
slow F-35 purchase
THIS WEEK P12

THIS WEEK

PROGRAMME DOMINIC PERRY LONDON

C-Series sales lag behind LCI's target

Leasing customer for Bombardier's developmental twinjet points to continued availability of medium-term delivery slots

One of the three leasing customers for Bombardier's developmental C-Series family has called on the manufacturer to up its sales efforts in order to fill out the medium-term backlog for the twinjets.

Mike Platt – chief executive of Lease Corp International (LCI), which holds commitments for 17 CS300s and three of the smaller CS100 – says that although he is pleased with the progress Bombardier is making, the company “needs to start turning that interest into orders from market-leading airlines”.

At 30 June, Bombardier had secured a total of 243 orders for the new jets – 53 CS100s and 190 CS300s – or around two to three years of production, depending on how sharply rates are ramped up.

However, Platt says that total is “not enough”, adding that the Canadian airframer needs to bring in “two marquee customers that will each take in excess of 25 aircraft”. At the moment, however, the leasing market has placed more than one-third of orders for the new jets, and two of the three largest commitments for C-Series aircraft have been placed

by lessors – with Macquarie AirFinance planning to take 40 CS300s and Ilyushin Finance 32 of the same variant.

Platt stresses that the sales effort is being hampered by the continued availability of so many medium-term delivery slots. “Right now, you can get positions, and if you know that, there's no urgency. Bombardier needs to create some urgency.”

He remains positive on the twinjets' performance and the strength of Bombardier's new management team, including president Fred Cromer and chief salesman Colin Bole, who both have strong backgrounds in the leasing industry.

However, he says that ultimately LCI could abandon its order – despite some pre-delivery payments having already been made – if more C-Series customers do not emerge.

“We don't want to walk away, we want to take these aircraft and put [our] money to use, but at the same time will we buy aircraft if there's no place to put them? I'll let you answer that,” says Platt.

Bombardier has not secured a firm C-Series order since September last year. ■



Lease Corp holds commitments to 17 CS300s and three CS100s

PROPULSION STEPHEN TRIMBLE WASHINGTON DC

PW1525G gives more thrust to family

Pratt & Whitney is rolling out the PW1525G – a new, higher-thrust version of its PW1500G engine – for the Bombardier C-Series family in the next two to three months, the fourth powerplant option for the CS100 and the third for the CS300.

P&W is developing the new variant of the engine to offer up to 5% higher thrust when the aircraft is moving faster than Mach 0.1 and at the maximum continuous thrust rating in flight. In static conditions the PW1525G will generate the same thrust as the PW1524G, which is rated to deliver up to 23,300lb (103kN), and requires no hardware modifications within the engine.

Bombardier says changes have been enabled by “a certain amount

of design margin” discovered in the powerplant, although it points out that running the engine at the higher thrust level will expose the components to hotter temperatures, increasing maintenance costs.

A software update for the PW1500G engine fleet is scheduled for release in September or October to enable the higher-thrust capability of the PW1525G. The PW1525G will allow a C-Series operator to carry a heavier load of passengers and cargo, or provide more range, or some combination of the two.

Two months ago Bombardier announced a 5% increase in the maximum range for the CS100 and CS300, up to 3,100nm (5,740km) and 3,300nm respectively. ■

STRATEGY JAMES DREW WASHINGTON DC

USAF report says Warthog will require replacement

A new strategy document by the US Air Combat Command points to the development of a future close-air-support (CAS) platform even as the service pushes to retire the long-serving Fairchild Republic A-10 from the role.

Although the document says current priorities are to modernise legacy fighters and bombers to cope with highly-contested airspace while working toward replacements – chiefly the Lockheed Martin F-35 and long-range strike bomber programmes – it says there is still a requirement to provide support to ground forces.

“We must continue to develop a balanced close air support capability across all platforms, explore opportunities for a future CAS platform, and... ensure we

maintain a CAS culture throughout the combat air force,” it says.

The push for a new CAS aircraft is a further indication that senior air force leaders are active-

ly pursuing an A-10 replacement – dubbed A-X – while they are seeking permission from Congress to mothball the in-service fleet. The USAF intends to replace the legacy type with the Lockheed Martin F-35A, which has basic air support capabilities.

Air Combat Command chief Gen Herbert Carlisle, who approved the strategic plan, said in March that the air force is exploring what will follow the A-10, potentially as a more affordable complement to the F-35, noting: “We're thinking about what an A-X would look like.” ■



The A-10's retirement will leave a close air support capability gap



SAFETY DAVID KAMINSKI-MORROW
LONDON

Buk named for first time during MH17 inquiry

Investigators looking into the likely shoot-down of Malaysia Airlines flight MH17 say they are examining components which might have originated from a Russian-built surface-to-air missile system.

The disclosure from the Dutch Safety Board is the first statement to mention a specific weapon system in connection with the loss of the Boeing 777-200ER and its 298 passengers and crew in July 2014. The joint investigation team is analysing "several parts", which "possibly" originate from a Buk system, it says, referring to a missile-launching platform produced by Russian manufacturer Almaz-Antey.

"These parts have been secured during a previous recovery mission in eastern Ukraine and are in possession of the criminal investigation team and the Dutch Safety Board," says the authority. While noting that "at present the conclusion cannot be drawn that there is a causal connection between the discovered parts and the crash of flight MH17", it adds that the parts hold "particular interest" to the investigators. ■

PROCUREMENT JAMES DREW WASHINGTON DC

'Budget realities' could see US Navy slow F-35 purchase

Service could receive between 12 and 20 Joint Strike Fighters per year through 2020s

Budget pressures and competing priorities could drive the US Navy to purchase fewer Lockheed Martin F-35Cs per year in the 2020s, with a worst-case scenario preparing the service for an annual acquisition of just a dozen aircraft.

Naval Air Forces commander Vice Adm Mike Shoemaker says the USN's current plan is to purchase around 20 examples of the carrier variant per year in the 2020s, but that depending on the resources available, annual deliveries could fall to as low as 12. Its acquisition plan currently calls for 369 aircraft to replace its Boeing F/A-18A-D Hornets.

"The current realities of the budget and other priorities inside the navy may drive something between those two numbers, but we're still on the path to [initial operational capability] for our first squadron in 2018," Shoemaker said on 12 August at the US Centre for Strategic and International Studies in Washington DC. "I'll keep working as hard as I can with our leadership to ensure we can



Unit costs of the carrier variant F-35C will only fall to \$144 million

stay on the path and get out of Classic Hornets and replace them with our F-35C as quick as we can."

Incoming chairman of the US Joint Chiefs of Staff, Gen Joseph Dunford, has set alarm bells ringing with a warning over reduced acquisition quantities, casting doubt on a long-held total requirement for 2,443 F-35s.

The navy is paying \$265 million per F-35C in its fiscal year 2014 order, and although this unit cost should fall to \$144 million in 2020, it far exceeds the forecast 2019 price of \$80 million for the US Air Force's F-35A and an \$80-90 million price tag for each F/A-18E/F Super Hornet. ■
See Defence P20

SPACEFLIGHT DAN THISDELL LONDON

Cost initiatives key as Ariane 6 contracts approved

Europe has approved contracts worth €2.4 billion (\$2.7 billion) to develop two variants of the Ariane 6 heavyweight rocket, with the new system to be flown from 2020 and ready to deliver full operations from 2023.

Prime contractor Airbus Safran Launchers says the total cost of developing the launcher, including solid fuel boosters which will be shared with the light Vega C rocket and some €400 million in industrial investment, will be about €3 billion. This includes €680 million until a preliminary design review in mid-2016.

A development of the Italian-led Vega project which has



A modular design will be adopted for ESA's heavyweight launcher

made five flawless flights since its February 2012 debut, Vega C will fly from 2018 under a €395 million deal awarded to ELV; a joint venture between Avio and

the Italian space agency ASI.

The plan is for Ariane 6 to fly a dozen times yearly for €70 million per launch. That cost expectation is underpinned by two ini-

tiatives. One is a modular design intended to support batch building of key components and cut order-to-launch times. The other is an overhaul of the industrial structure, which will halve the number of countries participating in Ariane 6 to six.

Airbus Safran Launchers also is expected – probably later this year – to take control of Arianespace by buying out French space agency CNES's current 34% holding.

The European Space Agency also has awarded CNES a €600 million contract to build a launch pad and preparation facilities for the Ariane 6 at Europe's spaceport in French Guiana. ■



Key Irkut MC-21 wing box components completed
AIR TRANSPORT P14

THIS WEEK

SUPPLY CHAIN DAN THISDELL LONDON

Industry health gauged with Precision

Takeover of components maker by Berkshire Hathaway part of renewed impetus for aerospace mergers and acquisitions

The blockbuster \$37.2 billion takeover of components maker Precision Castparts by Warren Buffett's Berkshire Hathaway group has the aerospace and defence industries on course for a record year of mergers & acquisitions (M&A) activity – but even without that “extraordinarily unique” deal, 2015 is set to be a “banner year” for company wheeling and dealing.

And, adds Scott Thompson, leader of consultancy PwC's USA aerospace and defence assurance practice, next year looks likely to continue the rising trend of dollar value M&A activity from the trough of 2013.

M&A activity is an important signal of the health of an industry, because it shows that buyers and sellers both see attractive prices – meaning buyers perceive good growth prospects and sellers can refocus portfolios or exit investments at a profit. And, the interest of financial investors like Buffett – noted for holding companies rather than buying and selling quickly to make trading profits – shows confidence in the long-term prospects.

Thompson was speaking on the back of new PwC figures that show the first half of 2015 to have been marked by \$12.4 billion spent on 19 aerospace or defence deals worth more than \$50 million, prior to the Precision purchase – or also for that matter its planned \$560 million takeover of machined components supplier Noranco, announced in late July – or the week's other M&A story, the acquisition by UK aerospace firm Meggitt of Cobham's advanced composites activities in a \$200 million cash purchase.

RECORD-BREAKER

Thompson notes that the buy-out of Precision – for \$32.5 billion, plus \$4.7 billion of assumed debt – is worth twice the previous sector record, which was United Technologies' 2012



Warren Buffett describes Precision Castparts as the global industry's “supplier of choice”

takeover of Goodrich for \$16.5 billion.

Buffett's purchase of the Portland, Oregon components manufacturer – where aerospace sales account for about two-thirds of its total revenue of some \$10 billion – is unusual, making it a poor signal of underlying trends.

“We [aerospace] are the best-looking cow at the fair”

RICHARD ABLOULAFIA
Analyst, Teal Group

But, says Thompson, the “facts persist”: commercial aerospace is attractive. Prices are expensive, he notes, but with so much growth built into the Airbus and Boeing order books and all forecasts pointing to continued global airliner demand over the coming decades, deals can be done.

Warren Buffett, for sure, sees the upside of his Precision investment, calling the company “the supplier of choice for the

world's aerospace industry”. That long-term faith in Precision, and aerospace, is in any case indicated by the \$235 per share Berkshire will pay, a premium of about 17% over the firm's closing price before the deal was known.

Richard Aboulafia, a Washington DC-based analyst with consultancy Teal Group, says: “Part of me was surprised for a deal of this magnitude to take so long with private capital.” Aerospace, he stresses, is a “safe haven” for investors who are sitting on large cash piles but struggling to find good returns; commodities, technology and emerging markets are all down, and even gold – briefly a safe haven following the financial crisis – has tanked.

“We [aerospace] are the best-looking cow at the fair,” he says.

Precision's aerospace business, he adds, is almost exclusively in supply to aircraft and engine makers, so Buffett may look for ways to increase its exposure to the aftermarket, traditionally a significant profit centre for parts suppliers. Ultimately, that

OEM focus means Buffett is placing a “big bet on commercial airliners” and, says Aboulafia, the skies ahead are not without dark clouds.

REAL DRIVER

Looking at aerospace through this particular prism of aircraft demand, Aboulafia notes that the real driver of new aircraft orders is the differential between fuel prices and interest rates. If fuel prices are low and interest rates rise – highly likely conditions in 2016 – that differential narrows: “The jaws snap shut, and that's not good.”

Whether Buffett returns to the aerospace market remains to be seen. His new acquisition will continue to trade as Precision Castparts, and maintain its Pacific Northwest headquarters. The deal, which should close in the first quarter of 2016, will take a chunk out of Berkshire Hathaway's \$67 billion cash pile.

But the prospects for other investors to take note of this takeover and look with some urgency for their own move on aerospace must be great. As Thompson observes, cash-rich investors are “hungry”. ■

PROGRAMME DAVID KAMINSKI-MORROW LONDON

Key Irkut MC-21 wing box components completed

United Aircraft division AeroKompozit has completed assembly of crucial components of the Irkut MC-21 wing box.

The fore and aft sections have been transferred to another part of the Ulyanovsk production centre which is working on the wing box frames.

United Aircraft says that the wing for the first flight-test MC-21 will be shipped to the Irkut assembly line in the autumn.

The MC-21 will have a 36m (118ft) span and it will be the first Russian passenger aircraft to



Wings on the twinjet will be made from composite material

have a composite wing. Its spars, panels and other components are being constructed of polymer

composites using an infusion process. Composites have enabled the developers to pro-

duce a wing which is lighter, says United Aircraft, while the use of single-piece structures reduces the need for fasteners.

Irkut is aiming to fly the first MC-21 in mid-2016.

It says that the high aspect-ratio wing will provide "high aerodynamic performance" and "fuel consumption reduction". Irkut adds that a "unique" assembly line is currently being developed to enable production of wings with the high-lift systems fully installed. ■

See Feature P36

NARROWBODIES DAVID KAMINSKI-MORROW LONDON

A319 the big loser as airlines upsize

Latest Airbus data shows carriers have continued trend of switching their orders for larger variants of single-aisle family

Airbus's latest backlog data shows that three customers have converted A320neo orders to the larger A321neo.

Qatar Airways has switched a pair of A320neos that were part of an order for 50 A320-family jets in 2011.

US lessor GECAS, which ordered 60 in the same year, has converted six, while an undisclosed customer has converted seven from an order placed in November last year.

The changes are further evidence of a shift towards the larger members of the single-aisle family.

Airbus had secured firm customers for 866 A321neos by 31

July, the airframer's backlog figures show, surpassing the total number of baseline A321s ordered before the launch of the re-engineered A320neo at the end of 2010.

Over the last five years the proportion of A321neos and A321s in the backlog has roughly doubled in size, to account for around 20% of the orders for their respective families.

This contrasts sharply with the A319neo, whose baseline counterpart had more than a 20% share of the Airbus single-aisle backlog in 2010. The A319neo has taken orders for fewer than 50 aircraft.

Meanwhile, the airframer re-



Operators are keen on biggest Airbus narrowbody

mains confident that it can begin A320neo deliveries before the end of the year, but acknowledges that is facing a greater time pressure.

Flight testing of the Pratt & Whitney-powered aircraft has resumed after an unscheduled stoppage lasting several weeks.

"The schedule for test flights and certification is now pretty tight," said group chief executive Tom Enders during a recent half-year results briefing. "[Development staff] will see very little of the summer vacation this year."

Enders says the second PW1100G-equipped airframe in the test fleet will return to flight "in the coming weeks".

Airbus Group is not disclosing the number of A320neo deliveries it plans to achieve by the end of the year.

Enders points out that, given that the new engines were the most significant change in the A320neo design, they were naturally going to involve the greatest risk. In addition, the airframer is still aiming to reach a decision by year-end on a possible further production rate hike for the A320 line.

Enders says Airbus had "clearly ticked the box" regarding demand for the type. It assembles A320s at a rate of 42 aircraft per month and has already committed to take this to 50 from 2017. ■

AGREEMENT

Norwegian to lease out 12 A320neos

Budget carrier Norwegian has confirmed it will lease a dozen Airbus A320neos to an undisclosed customer from next year.

The carrier has signed a letter of intent for the lease through its Dublin-based subsidiary Arctic Aviation Assets. All 12 aircraft are scheduled to be delivered in 2016 and 2017.

Arctic Aviation, which manages several aircraft for Norwegian, con-

firms the lease but has not identified the recipient airline.

Norwegian had indicated earlier this year that it was likely to pursue a lease-out of aircraft, initially of some A320neos, but later a number of its current Boeing 737-800s as the replacement Max variant begins to arrive from 2017 onwards.

Norwegian has 100 A320neos and 100 737 Max 8s on firm order. ■



Accident rate up in 2014 for US carriers, but no fatalities
AIR TRANSPORT P16

REGULATION STEPHEN TRIMBLE WASHINGTON DC

GENx restrictions could end as software fix is rolled out

Engine family is subject to US FAA curbs following problems with crystal ingestion in storms

GE Aviation plans to roll out a new software upgrade that could finally remove the last of the operating restrictions imposed two years ago on one of the engines that powers the Boeing 787-8.

The pending release of software version B185 for the engine's FADEC system represents GE's latest attempt to resolve the ice crystal icing problem for the GENx engine family.

Several GENx engines, including the GENx-2B model installed on the 747-8 as well as the -1B on the 787, experienced power loss after ingesting tiny crystals as aircraft flew into strong tropical thunderstorms at high altitude.

In hopes of fixing the problem, GE has since rolled out FADEC software versions B178 and B180. After building up on fan blades, the ice crystals eventually begin to shed, potentially entering the compressor and extinguishing the combustor. The software allows the FADEC to detect the conditions when shedding is likely.



Safety mandate hit Boeing 787s fitted with GENx-1B powerplants

At that point, the FADEC commands a set of variable bleed valve doors – normally used to scoop up foreign objects swallowed by the engine during take-off – to open, allowing ice crystals to shed harmlessly into the bypass airflow around the engine core.

The US Federal Aviation Administration had previously barred aircraft powered by the GENx-1B or GENx-2B from flying within 50nm (93km) of a storm

that had the potential of producing high-altitude ice crystals.

But the release of software versions B178 and B180 prompted the FAA to relax the restrictions, allowing the 787 to operate below 37,500ft in such conditions and the 747-8 to fly below 35,500ft without changing their routes.

The latest B185 software is almost ready and could convince the FAA to remove the operating restrictions entirely, GE says. ■

MANUFACTURING DAVID KAMINSKI-MORROW LONDON

Partners brand drive-train tie-up Aero Gearbox

Rolls-Royce and Hispano-Suiza have branded their drive-train venture Aero Gearbox International, with the Trent 7000 among the first engines to benefit.

Aero Gearbox International will establish a production facility in southeast Poland, the site of a number of aerospace centres. Work on the centre will begin this year.

R-R and Safran subsidiary Hispano-Suiza disclosed their plan for a drive-train venture for civil aircraft engines last year.

The company will design and produce accessory drive trains for business jets as well as the whole range of commercial types powered by R-R engines.

These will include the Airbus A330neo, which will be fitted with the Trent 7000. R-R says the Polish plant will start delivering in 2017 and the Trent 7000 will be one of the first recipients of the venture's product line.

Aero Gearbox will initially have 60 personnel located in Colombes, Derby and Dahlewitz. But the new plant – to be established in the Podkarpackie region of Poland – will have a staff of some 110 specialists. ■

PROPULSION DAVID KAMINSKI-MORROW LONDON

Perm to become hub for Russia's engine ambitions

Russian aerospace strategists are examining the potential of Perm as a centre of development for higher-thrust powerplants.

Deputy prime minister Dmitry Rogozin outlined the possibility to Russian president Vladimir Putin during a recent meeting.

Rogozin describes engine development as a "priority of engineering" for the civil and military aircraft industries, to reduce the country's dependence on import.

He points out that development of engines needed to precede that of aircraft models by several years, and that the industry could capitalise on work conducted at the

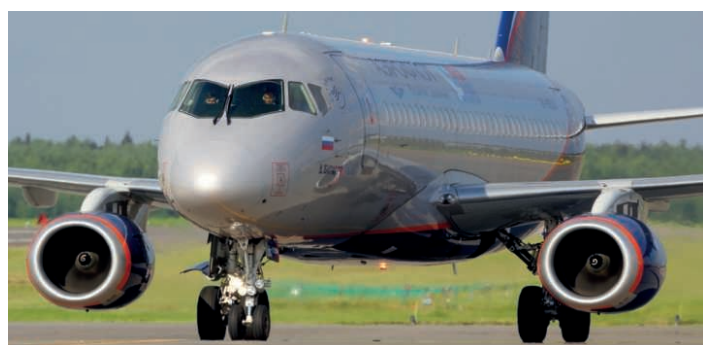
Perm Motors facilities, noting the creation of the Aviadvigatel PD-14 for the Irkut MC-21.

Rogozin told Putin, according to the official office of the presidency, this work would allow the expansion of powerplant development in the 9-16t range of take-off thrust.

This would generate the potential to develop new engines for future models of the Sukhoi Superjet 100 as well as a 210-seat version of the MC-21, he adds.

Rogozin says the plan would also enable evolution of engines for the military and heavy helicopter sectors.

United Engines, which is the



Russian industry could develop engines for future Superjet models

holding company for all of the country's aerospace propulsion manufacturing and design activities, has previously stated that one

of its core ambitions is to expand its presence in the civil market, both domestically and overseas. ■

See Feature P39

SAFETY JON HEMMERDINGER WASHINGTON DC

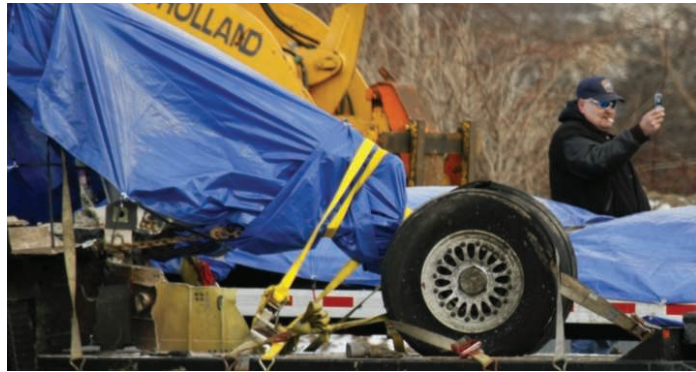
Accident rate up in 2014 for US carriers, but no fatalities

Data shows slight increase in incidents involving scheduled flights, but no resulting deaths

US airline accident rates inched up last year, although 2014 marked the fifth consecutive year that no passengers were killed on scheduled flights operated by US-registered carriers.

According to preliminary figures released by the US National Transportation Safety Board (NTSB), in 2014, US airlines operating scheduled and non-scheduled flights under part 121 regulations suffered 28 accidents out of more than 9 million departures.

The resulting 2014 accident rate of 0.311 per 100,000 departures was up from the 2013 rate of 0.248. That year, airlines suffered 23 accidents, two of them involving fatalities. Still, 2014 was a year in which there were no accidents that the NTSB deemed "major" or even "serious", meaning none resulted in fatalities to passengers or crew.



50 people died when a Q400 crashed near Buffalo in 2009

Though two crashes in 2013 killed a total of nine crew members, no passengers have been killed on US airliners since 12 February 2009, when a Colgan Air Bombardier Q400 crashed near Buffalo, causing 50 deaths.

By comparison, the global airline fatal accident rate in 2014 was one event per 2.38 million flights,

according to Flightglobal's Ascend consultancy.

That is not to say there were no accidents in 2014, however. The NTSB's tally includes 13 that caused injuries and 15 that substantially damaged the aircraft. However, no hull-loss incidents were recorded.

Among the most notable incidents last year was the aborted take-off in Philadelphia of US Airways flight 1702 on 13 March in which the nose gear collapsed.

There was also an improvement seen among commuter carriers operating under part 135 regulations, where accidents declined to 0.635 per 100,000 departures, down from a rate of 1.186 in 2013.

Commuter carriers were involved in four accidents in 2014, none causing fatalities. In 2013 there were seven commuter accidents, two of them causing deaths, NTSB data records. ■

REPORT

ELLIS TAYLOR SINGAPORE

Flight mode error led to conflict on Sydney approach

Investigators have concluded that an incorrect flight mode setting was the main catalyst for a loss of separation incident involving a Virgin Australia Boeing 737-800 (VH-YIR) and a Jetstar Airways Airbus A320 (VH-VHL) on final approach to Sydney.

In its final report into the 4 June 2013 event the Australian Transport Safety Bureau (ATSB) says the Virgin 737 was on an independent visual approach to Sydney airport's runway 16R.

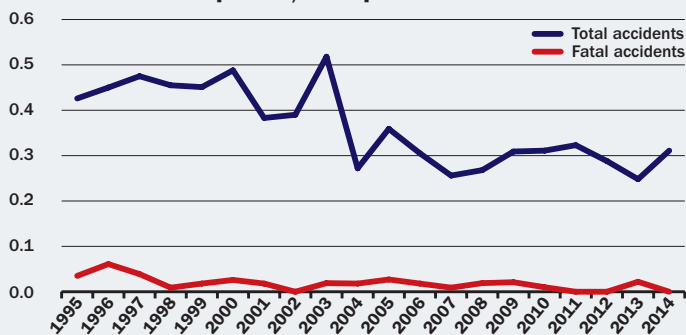
As it approached the extended centre-line of the runway, the airport's traffic collision avoidance system (TCAS) provided a traffic alert and a resolution advisory in relation to the Jetstar A320, on approach to the parallel runway 16L.

The pilot of the 737 descended until the TCAS alert ceased, and captured the extended centre-line from the other side, while the A320 executed a go-around. The 737 passed through the centre-line because its automatic flight control system was not set in the correct mode to intercept and turn onto the runway localiser.

The ATSB also found that the risk of an undetected mode selection was higher as Virgin did not require flight crew to announce flight mode changes. The carrier has since updated its procedures to address this. ■

ACCIDENT RATE FOR PART 121 CARRIERS

Number of accidents per 100,000 departures

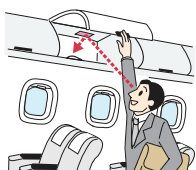


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SAFETY DAVID KAMINSKI-MORROW LONDON

Fire source unclear in Asiana crash

Korean investigation details 747-400 freighter's last moments off Jeju, saying blaze probably began in aft main deck

Korean investigators have been unable to determine the origin of the fire which brought down an Asiana Airlines Boeing 747-400 freighter off Jeju.

But the inquiry believes it started in the vicinity of two pallets, loaded in the aft main deck, which were carrying dangerous goods.

The blaze spread "rapidly", says Korean investigation authority ARAIB, and could not be suppressed.

Control over the flight deteriorated and neither of the two crew members survived after the aircraft – operating from Seoul to Shanghai on 28 July 2011 – crashed into the sea.

While the precise cause of the fire could not be established, the inquiry points out that two pallets close to the rear freight door had been carrying lithium-ion

batteries as well as highly-flammable and corrosive liquids.

Just 3min after the flight was handed from Incheon to Shanghai area control, the crew requested an emergency descent from 34,000ft to 10,000ft, citing a main-deck fire.

Data relayed by the ACARS communication system on the 747 shows that the initial fire alert was triggered in main deck zone 11, just ahead of the rear freight door.

Several more alerts were transmitted, from other fire sensors in the main deck, over the next 2min.

The ACARS data also indicates that multiple aircraft systems began to fail in quick succession.

Within 5min of the emergency declaration the system recorded alerts for flight-control systems, the satcom data unit, air condi-



The freighter was carrying lithium-ion batteries among its cargo

tioning packs, yaw damper and the auxiliary power unit.

This system deterioration continued and control of the crippled 747 ebbed away from the crew.

Critical flight systems were lost and the pilots – who said the aircraft was shaking "violently" – were unable maintain altitude. The crew told Jeju approach con-

trol they were going to attempt a ditching, but there was no more contact.

Following a partial mid-air fuselage break-up, wreckage was found underwater at a depth of around 85m over an area of 3km by 4km.

Flight data and cockpit voice recorders were not recovered. ■



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Trim error caused
NATO training crash
DEFENCE P21

CONTEST JAMES DREW WASHINGTON DC

US trio kept on JSTARS Recap target

Boeing, Lockheed and Northrop all receive funding support for risk-reduction phase studies into successor for E-8C fleet

The US Air Force has picked Boeing, Lockheed Martin and Northrop Grumman to carry its Joint Surveillance Target Attack Radar System (JSTARS) Recapitalisation programme forward.

Announced on 7 August, contracts with the three companies are worth between \$10 million and \$11.5 million each, for a one-year pre-engineering and manufacturing development (pre-EMD) effort aimed at maturing and testing their designs ahead of a downselect decision in late 2017.

The USAF had anticipated awarding “up to three” contracts on its way to eventually replacing its 16 Boeing 707-300-based Northrop E-8Cs with the same or better ground-surveillance and battle management capability based on a smaller business jet platform. The service’s contract announcement – which covers activity until 31 July 2016 –



A platform based on the 737-700-derived BBJ1 is one candidate

reveals that four offers were received, pointing to a rejected bid.

Boeing intends to offer a next-generation JSTARS based on its 737-700-derived BBJ1, while Lockheed and Northrop’s designs are respectively based on the Bombardier Global 6000 and an undisclosed Gulfstream model. The latter is working on a replacement system using a G550 testbed.

Northrop and Raytheon are the two primary radar providers in

contention, with the former considering different options within its portfolio, depending on the final requirements. Raytheon is offering a “Skynet” radar – an improved version of its Advanced Airborne Sensor – to all bidders.

“Contractor activities will help assess maturity of subsystem technology, reduce weapon system integration risk, and lower life cycle cost,” the USAF says of the pre-EMD risk-reduction phase.

The service’s acquisition chief, William LaPlante, recently said that flying prototypes are preferable, and the designs must comply with new open-architecture standards that have been defined by an industry and government consortium.

A subsequent competition will lead to an EMD contract for two test aircraft, which should be followed by the low-rate production of three aircraft for initial operational capability in late 2023. Another 12 aircraft would be purchased through 2024, for a fleet total of 17.

The current JSTARS capability made its combat debut during Operation Desert Storm in 1991, and the last E-8C aircraft was delivered in 2005. A retirement of the fleet is due to start in fiscal year 2019, with the aircraft becoming increasingly difficult and expensive to maintain. ■

FINANCE JAMES DREW WASHINGTON DC

Brazil agrees improved Gripen terms

Brazil’s air force has moved a step closer to securing 36 Saab Gripen NG fighters, after the federal senate approved a renegotiated financing agreement with Sweden early this month. The agreement lowers the interest rate linked to the acquisition from 2.54% to 2.19%.

The Brazilian defence ministry says the senate authorised a loan of \$4.6 billion on offer from Sweden’s export credit agency SEK at the lower interest rate, plus another \$245 million for an associated weapons package, first outlined in late April.

The reduced interest rate had previously been announced by the Brazilian government, following extensive negotiations with Sweden amid a budget crisis that has already seen Embraer’s KC-390 tanker-transport project delayed by two years.

Senate approval for the package

will finance the procurement of aircraft, armaments and logistics support for the F-X2 project. The Gripen NG was selected in December 2013 for the requirement, following a competition also involving the Boeing F/A-18E/F Super Hornet and Dassault Rafale.

Of the 36 aircraft, 28 will be single-seat fighters produced in Sweden, with the remainder to be two-seat examples developed and built in Brazil. According to the

defence ministry, the “first aircraft will be delivered in 2019 and the last in 2024”. Saab has pledged a high level of technology transfer to Brazil over the next 10 years, as well as substantial local industrial participation, with Embraer as the main benefactor.

Under the terms of the new agreement, Brazil will pay back the loan from Sweden over 25 years, with an eight-year grace period. ■



The country will acquire 36 NG-model fighters, starting in 2019

ROTORCRAFT ARIE EGOZI TEL AVIV

Israel makes ‘King Stallion’ a top priority

Sikorsky’s CH-53K heavy transport helicopter has emerged as a formal operational requirement for the Israeli air force, despite its more immediate need to obtain the Bell Boeing V-22 tiltrotor.

Describing the 40t “King Stallion” as a “very high priority” item, a senior air force officer tells *Flight International* that “the CH-53K will be part of our future helicopter fleet”.

Now expected to achieve initial operational capability status with the US Marine Corps during 2019, the CH-53K would serve as a replacement for the Israeli air force’s recently-upgraded CH-53 “Yasur” fleet. The current model is expected to remain in use until at least 2025. ■



OPERATIONS

Gunship debut for MD530F in Afghanistan

Afghanistan's air force has used its MD530F Cayuse Warrior scout-attack rotorcraft in combat for the first time, while MD Helicopters works to add M260 70mm rocket launchers and a fixed-forward weapon sight to its fleet.

Aircraft armed with 50-calibre machine guns and ballistic armour protection operated alongside Afghan Mil Mi-17 transport helicopters on 11 August, against insurgents near Jalalabad.

Afghanistan has flown the MD530F since 2011, initially for pilot training. Last year it contracted MD Helicopters to adapt an eventual 17 of the type to a "Jengi" gunship configuration. ■

CAPABILITY JAMES DREW WASHINGTON DC

USAF squadron all set to welcome first pair of combat-rated F-35As

The US Air Force's lead pair of "combat-coded" Lockheed Martin F-35A Lightning IIs have come off the company's assembly line at Fort Worth in Texas, with the second aircraft having completed its debut flight on 4 August.

Aircraft numbers AF-77 and AF-78 are now being readied for delivery to Hill AFB in Utah, where they will be flown by the USAF's first operational F-35 unit, the 34th Fighter Squadron.

Formerly equipped with Lockheed F-16s, this was reactivated in July and aims to declare initial operational capability with at least 12 F-35As in August 2016.

"Very soon, both AF-77 and AF-78 will be taking off from Hill



AF-77 and AF-78 are being readied for delivery to Hill AFB in Utah

AFB," says the squadron's parent unit, the 388th Fighter Wing.

Lockheed has already begun delivering parts and supplies to the base to sustain the first few aircraft, due to arrive in September. The Ogden Air Logistics Center at the same site also is the

primary location for depot maintenance of the A-model fighter.

As of 20 July, Lockheed had delivered 65 F-35As to the USAF, plus four to international customers. The former's programme of record calls for the production of 1,763 of the aircraft. ■

CONTRACT DOMINIC PERRY LONDON

Warsaw defends selection of H225M

Polish media reports suggest procurement rules were broken following choice of Caracal for 50-unit tri-service requirement

Poland's defence ministry has reacted angrily to suggestions in the nation's media that it broke procurement rules by selecting the Airbus Helicopters H225M for a 50-unit multi-role rotorcraft tender.

Warsaw is already facing a legal challenge from one of the competition's losing bidders – AgustaWestland subsidiary PZL Swidnik – over the way the contest was handled, and the latest allegations have added to the outcry over its decision.

But in a lengthy statement posted on the defence ministry's website, its legal director Col Mariusz Tomaszewski defends the acquisition process and says a report in the *Wprost* weekly contains "inaccurate and false information".

Wprost says that four months on from the selection of the H225M in April for the tri-service deal, the contract is no closer to being finalised – particularly around industrial offsets. With national elections due in the au-

turn, it suggests that officials from both the defence and economic affairs ministries are anxious to leave any decision to the next government.

The report also claims that the H225M Caracal failed to satisfy a number of criteria in Warsaw's tender specification, rendering its selection invalid. These include the lack of a folding tail boom, issues with the target designator and the speed with which the

cabin can be reconfigured. Given these issues, *Wprost* questions how the type could have been picked over the competing AgustaWestland AW149 and Sikorsky's S-70i Black Hawk and S-70B Seahawk.

Tomaszewski counters that the acquisition process was entirely legal and above board, and insists that the competing offers "did not meet the formal requirements" of the tender. During verification tri-

als in May the Caracal satisfied all of the 32 "critical parameters" tested, he says, adding that Airbus Helicopters has promised to deliver the required specification – including items like the folding tail boom for the 14-15 examples destined for Polish navy service.

Negotiations with the manufacturer to determine the final contract value are ongoing, he says.

Previous reports have suggested the acquisition is worth up to Zł13 billion (\$3.5 billion), but Tomaszewski says the final figure will not be known until the conclusion of negotiations covering the provision of "a training package, simulator, and the construction of a logistics centre".

Airbus Helicopters will localise production of the Caracal as part of the deal, in partnership with Lodz-based WZL-1. AgustaWestland and Sikorsky both already have local manufacturing capabilities through their respective PZL Swidnik and PZL Mielec subsidiaries. ■



The selected type meets critical parameters, says defence ministry



Vulcanair prepares V1.0 for handover by year-end
GENERAL AVIATION P22

INVESTIGATION BETH STEVENSON LONDON

Trim error caused NATO training crash

Maximum right yaw deflection on Greek F-16D led to aircraft loss and 11 deaths during multinational exercise in Spain

A Greek air force Lockheed Martin F-16D which crashed during a multinational training exercise on 26 January had not been properly trimmed for take-off, according to NATO investigators tasked with determining the cause of the mishap, which killed 11 people.

Before the crew began taxiing at Albacete air base in Spain, the yaw trim on their aircraft had inadvertently been set to a maximum right deflection of 12°, which “drastically” affected its aerodynamics during take-off, a final report says.

A trim check, which includes ensuring that the pitch and yaw trim knobs are centred, is part of the “before take-off” procedures, which were carried out while the F-16 was at the parking area 20min before the flight. This was deemed by the NATO



Action Press/Ree Shufensack

Both crew members died when they lost control soon after take-off

safety investigation board to have been “very early”.

Other contributing factors included the manual trim panel not being designed to prevent all inadvertent movement, and the aircraft not having a means of alerting the pilot if it was incorrectly configured.

“The coexistence of a number of critical factors led the accident to a fatal level,” the report

says. It identifies these as having included “heavy gross weight, asymmetry configuration, two-seat model, external fuel tanks [mainly centreline] and crosswind”.

“The fact that this unintended rotation of the yaw trim knob is uncommon, especially of this severity, did not lead HAF [Hellenic air force] flight training and flight safety structures to

deal with this issue at an appropriate level,” the investigators say. Unsecured objects falling in the cockpit could also have led to the yaw trim knob being moved, they add, while noting that there were no related emergency procedures and no previous recorded incidents of this type in Greek service.

One of two aircraft from the Greek air force’s 341 Sqn that were performing a formation take-off during a Tactical Leadership Programme training course, the F-16D – a 1997-built example with the tail number 084 – crashed 7.8s after becoming airborne.

Both Greek pilots were killed, along with nine French air force personnel on the ground. The impact and post-crash fire also damaged or destroyed another eight aircraft. ■

ACQUISITION BETH STEVENSON LONDON

Madrid nears MALE UAV choice as funds allocated

Spain is close to selecting a medium-altitude, long-endurance (MALE) unmanned air vehicle, with an initial €25 million (\$28 million) having been allocated for the acquisition in the nation’s 2016 defence budget.

Two types are under consideration, with General Atomics Aeronautical Systems teamed with Sener to offer the MQ-9 Predator B, and Israel Aerospace Industries working with Indra to promote the Heron TP.

A decision is expected next year, with Spanish newspaper *El País* claiming that the total re-

quirement is for four UAVs and two ground control stations – one fixed and one mobile. A five-year contract for the period to 2020 is expected to value €171 million.

While some reports suggest that Madrid has already followed France, Italy, the Netherlands and the UK by selecting the Predator B, General Atomics tells *Flight International* that no decision has been announced. IAI declines to comment.

The selected platform will be delivered in a surveillance-only configuration, and made available as a joint service capability. ■



General Atomics Aeronautical Systems

The Predator B is under consideration, along with IAI’s Heron TP

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ANALYSIS STEPHEN TRIMBLE WASHINGTON DC

Safety problems persist for GA sector

Figures from the US NTSB for 2014 reveal a 17-year high in fatal accidents despite a 7% decline in reported flight hours

The US general aviation community reported the highest rate of fatal accidents since 1998 last year, although overall accident rates were only the seventh highest in that 17-year period.

Figures released by the US National Transportation Safety Board (NTSB) in early August showed that the rate of accidents is not declining, even though the number of general aviation flight hours is lower than it has ever been.

The overall accident rate in general aviation rose about 7% year-on-year to 6.74 per 100,000 flight hours in 2014, the NTSB says. But the rate of fatal accidents jumped 25% from 2013 to 2014, rising to 1.4 per 100,000 flight hours.

At the same time, the overall number of flight hours reported by general aviation pilots declined in 2014 to a new low of 18.1 million; down by 38% since

a modern peak set in 1999 and 7% lower compared with 2013.

The accident rate for the general aviation sector continues to track well above that of aircraft operated in the more heavily regulated Part 135 category, which reported an overall accident rate of 1.02 per 100,000 flight hours in 2014, including a rate of 0.23 fatal accidents.

General aviation remains the only segment in air transporta-

tion that is consistently targeted on the NTSB's annual list of "most wanted" safety improvements – which are mainly focused on rail, roadway and marine transportation sectors.

In 2015, the NTSB highlighted the need to reduce the number of "loss of control" incidents in general aviation, in which pilots often stall at low speed while on final approach or immediately after take-off. ■

PROGRAMME KATE SANSFIELD LONDON

C4 prototype nears flight debut

German light sport aircraft (LSA) manufacturer Flight Design is readying the first of three C4 production prototypes for its debut flight in the third quarter, as its first certificated aircraft advances towards European validation and service entry in the middle of 2016.

The proof-of-concept prototype made its maiden flight in April from the company's headquarters in Kamenz near Dresden, and the four-seat model has since notched up around 15h, according to Flight Design's US president Tom Peghiny.

"One of the three production prototypes will be shipped to the US for the FAA [Federal Aviation Administration] certification programme," he says.

The USA is expected to account for around 50% of C4 sales, Peghiny says. In anticipation of growing demand for the Continental IO-360-AF-powered aircraft,

Flight Design is planning to establish an assembly facility somewhere in the east of the country.

Flight Design already has production facilities in Germany, Ukraine and China, which build its CTLS LSA for the European, US and Asian markets. The company recently broke ground on a second production facility in China, which will house CTLS and C4 production.

The high-wing, four-seat type is one of the first aircraft to be designed with the rewrite of the FAA/European Aviation Safety Agency Part/CS-23 certification rules in mind. The refreshed safety standards – which are expected to be introduced next year – are designed to streamline and simplify airworthiness requirements for most piston, turboprop and light turbine aircraft, and ultimately reduce the development cost of new models and equipment. ■



Full-scale production of the piston single began earlier in 2015

DEVELOPMENT KATE SANSFIELD LONDON

Vulcanair prepares V1.0 for handover by year-end

Italian airframer Vulcanair hopes to complete certification of its first piston-single, the V1.0, by the end of the third quarter and hand over the initial example of the four-seat aircraft to an undisclosed customer by year-end.

"Certification testing is almost complete," says Vulcanair director Remo De Feo. "We have just finished testing the V1.0's 180hp Lycoming IO-360-M1A engine with Mogas fuel. In September we will conduct noise testing [the final European certification requirement] and begin deliveries soon after approval."

US validation of the high-wing aircraft is expected around the middle of 2016, opening up a po-

tentially huge market for the Casoria, Naples-based airframer.

Full-scale production of the V1.0 was launched earlier this year, and a number of aircraft are now being assembled at Vulcanair's facility. Priced at €233,000 (\$257,000), the aluminium type fits in the market sector between top-end light sport aircraft such as the P2008 – developed by fellow Italian airframer Tecnam – and entry-level piston-singles like the Piper Archer, says De Feo.

The V1.0 has a maximum take-off weight of 1,160kg (2,550lb), a maximum cruise speed of 130kt (241km/h), a range of 589nm (1,090km) and a luggage capacity of 40kg. ■



The proof-of-concept aircraft has flown 15h since its April debut



Legacy 450 gets
certification nod
SHOW REPORT P24

AMPHIBIAN STEPHEN TRIMBLE WASHINGTON DC

Burt Rutan floats seaplane concept

Legendary aerospace designer emerges from retirement to unveil the SkiGull – his vision for a new amphibious aircraft

Prolific aircraft designer Burt Rutan has emerged from a brief retirement to unveil a new seaplane design he claims can seat two people, fly up to 2,100nm (3,890km) non-stop, survive a 10g impact on rolling seas and fit inside the one-car garage of his lakeside home.

Any other designer might invite scepticism with such claims, but Rutan has a reputation for defying limits. His notable firsts include the non-stop, round-the-world flight of Voyager, the first private suborbital flight of SpaceShipOne, endurance record-setter Global-Flyer and 43 other novel designs.

Indeed, Rutan credits his own record for driving him to make a new seaplane – named the SkiGull – that exceeds the range and efficiency of most land aircraft, but which is flexible enough to operate from water or land.

“I did Boomerang and Voyager. Why would I not do something for a seaplane that was just a little better?” Rutan said at the Experimental Aircraft Association’s Air-Venture fly-in in Oshkosh, Wisconsin, in late July.

The design of the SkiGull began with Rutan listing all of the annoyances about seaplanes that he wanted to overcome.



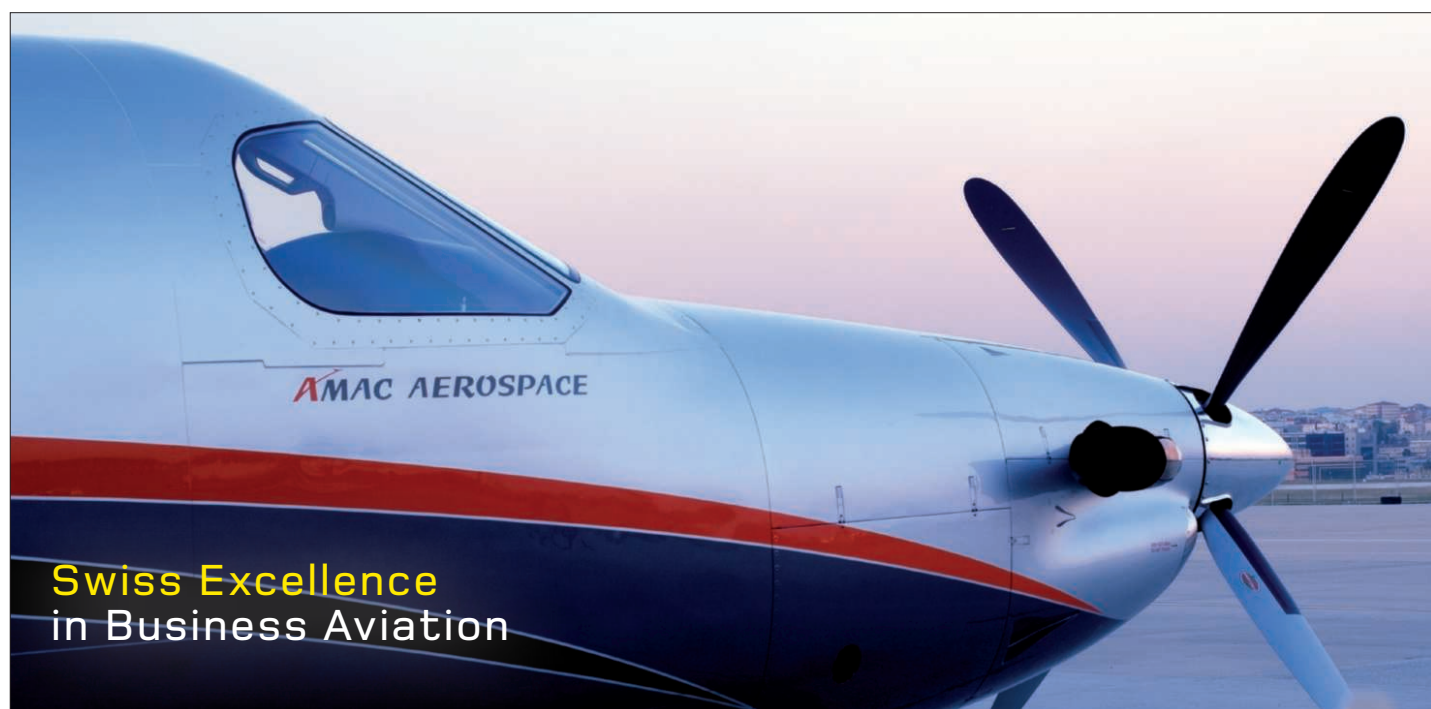
Design features include shock absorbers and a strut-braced wing

Some were as simple as installing shock absorbers. Noting that most seaplanes land on rougher surfaces, Rutan says incredulously: “Why have people not put shock absorbers on a seaplane? They’re the guys that need it!”

For enough range to fly non-stop from San Francisco to Honolulu, Hawaii, Rutan designed the SkiGull with a 14.3m (47ft), strut-braced wing and what he calls the world’s most efficient aircraft engine: a Rotax 912iS.

Another Rutan irritation with seaplanes is the lack of power, with an engine-out on take-off especially risky if it is necessary to clear trees on the shore. So he is installing an auxiliary electric power system that can provide an extra 30% thrust on take-off.

But Rutan emphasises that he has not yet flown the SkiGull. An attempt to assemble the aircraft ended three weeks before the Air-Venture event, when he realised the skis needed redesigning. ■



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LABACE 2015



Sometimes the show, as they say, simply must go on. This is not a great year to hold a business jet exhibition in São Paulo, with the Brazilian economy in a politically-induced crisis. A market that once reliably grew at rates above 6% annually cooled last year to 3%, and may struggle to stay in positive territory in 2016. But a visibly reduced crowd came to the Latin American Business Aviation Convention and Exhibition (LABACE) anyway, perhaps seeking an opportunity to be ready when the market eventually rebounds. Report by Stephen Trimble

START-UP

Regional ATR carrier has ambitious plans to grow

An ATR 72-500 turboprop made arguably the most unlikely debut among the business jets at LABACE, with the VIP-roled model intended to spotlight an aspiring new charter company and regional airline.

Rio de Janeiro-based Star Consultoria Aeronautica – ATR's sales agent in Brazil – plans to launch a start-up regional carrier called Flyways Linhas Aereas, initially operating routes from the city's two airports to Brasilia and Minas Gerais.

The carrier could be activated within weeks, says Pedro Paulo

Valverde Pedrosa Junior, a director at Star. By the end of 2016, Flyways hopes to operate up to 10 used ATR 72-500s or -600s covering an expanding regional network.

The ATR 72-500 on show can be configured with 48 or 72 seats for charter, and since the launch of the operation earlier this year has flown several of Brazil's biggest football teams and rock bands.

"Other companies in Brazil are so big," Pedrosa Junior says. "They can't offer something different to the client." ■

PROGRAMMES

Legacy 450 gets certification nod

Approval marks last service entry from Embraer's business jet push, as weak economic conditions hinder sales efforts

Brazil's civil aeronautics authority (ANAC) on 11 August announced the approval of type certification for the Legacy 450, ushering into service the seventh and last jet in a market-bending, 15-year-long Embraer quest to become a powerhouse in the business aviation market.

The Legacy 450 follows by one year the introduction of its slightly larger and longer-range sibling, the Legacy 500, as well as the Lineage 1000, Legacy 650 and 600 and the Phenom 300 and 100 jets.

From having no position in the business aviation market 15 years ago, Embraer now occupies seven of eight major market segments, ranging from the entry-level Phenom 100 to the airliner-derived Lineage.

The Legacy 450 fills a critical gap that bridges the size normally found in the super-light category and performance usually associated with midsize jets. It will compete against the Cessna Citation Latitude, which achieved certification from the US Federal Aviation Administration two months ago.

The type certificate for the Legacy 450 was granted after ANAC verified 1,600 requirements in ground and flight tests. Embraer's newest jet also benefited from the previous type approval for the

Legacy 500, which verified 7,500 test points, Dino Ishikura, head of ANAC's airworthiness department, said at the show.

The Legacy 450 and Legacy 500 have both entered the production phase amidst a global softening of sales in the midsize segment. Embraer's timing also coincides with an unfolding economic crisis in Brazil, where both types are expected to compete especially well against rivals.

LIMITED MARKET

In late July, Embraer announced only five Legacy 500s had been delivered in the first half of 2015. The company had planned to ramp up slowly to incorporate reliability improvements, but the market's softness also has limited sales.

"2015 was not as good a year as we thought," Embraer executive jets president and chief executive Marco Tulio Pellegrini tells *Flight International*.

But Embraer expects a "hot second semester" for aircraft deliveries, Pellegrini adds, and much better conditions in 2016.

Embraer plans to obtain type certificates for the Legacy 450 from the US Federal Aviation Administration and the European Aviation Safety Agency within a few weeks, followed by a first customer delivery during the fourth quarter. ■



Deliveries of the Legacy 450 will start later this year



Brazil beckons Twin Otter, says Viking
SHOW REPORT P26

LEASING

Industry stalwart heads Waypoint's Brazil venture

Ireland-based helicopter lessor Waypoint Leasing is establishing a local office in Rio de Janeiro, to support a growing fleet of operators in Brazil and – in the future – the rest of Latin America. It will be staffed by Steffen Bey; a veteran of Airbus Helicopters and operators Era and its local partner Aero-leo Taxi Aero.

“Steffen was spending his time in the wrong time zone, in Limerick [Ireland],” says Clark McGinn, Waypoint’s senior vice-president of sales and relationship management. “Now he is going to be here in the office, helping solve those

day-to-day bits of schtick that just come with the helicopter world.”

Operators including Lider Aviação and Brazilian Helicopter Services lease a total of 10 rotorcraft from Waypoint, with a new sale-leaseback deal announced with the former on 11 August, for one Sikorsky S-92.

Waypoint is preparing to wait for a full recovery in the oil-and-gas sector to start after 2016. But leasing helicopters is one way for operators to manage their fleets during slumps, McGinn says.

“A manufacturer has told me, ‘I sell helicopters, you sell



The lessor is to supply another Sikorsky S-92 to Lider Aviação

money’. But that’s wrong. We’re not selling money. We’re selling the ability to right-size your fleet at a specific time.”

The lessor has also recently established local offices in London and Singapore. ■

See News Focus P27

AIRFRAMES

HondaJet lands more orders

Manufacturer hopes to establish its lightweight jet in the region as type certification nears

Honda Aircraft continued a four-month-long “world tour” in São Paulo, with the HondaJet making its LABACE debut from 11 August.

While the long wait for the type to receive airworthiness approval from the US Federal Aviation Administration continues – and with no clear timeline offered by the North Carolina-based manufacturer – it announced receiving “multiple orders” at the event.

The FAA granted the HondaJet a “provisional” type certificate in March; a step which often implies that the full airworthiness approval usually demanded by customers before accepting delivery is either weeks or a few months away.

Speaking at the show, HondaJet chief executive Michimasa Fujino said he expects certification to be achieved in “late summer”, with the caveat that the timing depends on the FAA’s procedures. The latter, however, seems to be still evaluating special airworthiness issues for the lightweight jet, which is the first to seek type approval in the USA with over-the-wing-mounted engines.



Brazil was the latest stop during lightweight jet’s world tour

On 12 August, the FAA published a new “special condition” for the HondaJet to prove its airworthiness.

The HondaJet has already been the focus of several special conditions – which cover a variety of issues that arise during type certification for which there are no regulations – covering items ranging from extinguishing fires in the engines (subsequently withdrawn), to the use of lithium-ion batteries as a back-up power supply. The lat-

est special condition addresses the need for a back-up pressurisation system at altitudes over 41,000ft, as its developer seeks to operate at up to 43,000ft.

Honda Aircraft hopes to quickly establish the HondaJet in the Latin American market, where it faces competition from the Embraer Phenom 100 and Cessna’s M2 entry-level jet. The manufacturer has partnered with Brazilian dealer Lider Aviação as its local representative for sales, service and support. ■

TRAINING

University opens site in response to airport boom

Daytona, Florida-based aviation training and education services provider Embry-Riddle Aeronautical University (ERAU) has opened an office in São Paulo, and launched a human factors training course in partnership with Porto Alegre-based Pontifical Catholic University of the Rio Grande.

The move coincides with a Brazilian government plan to refurbish or build 270 regional airports. In July, government officials reported that planning for the first 64 airports has been finalised.

Brazil’s infrastructure initiative could generate demand for thousands of trained airport, air traffic control and aviation workers, says John Watret, president of ERAU. Its plan is to build in Brazil gradually, starting with not-for-credit courses aimed at training a new cadre of airport managers and flight crews.

The cautious approach is being driven by the country’s current economic crisis, which could limit the rate of growth.

“That’s why we’re starting off slowly, building up with a few courses rather than coming in with a large infrastructure that may not succeed,” Watret says. ■

MARKET

Brazil beckons Twin Otter, says Viking

Canadian company plans sales drive into Latin American nation, where it sees big opportunities for its modernised DHC-6

Vancouver Island-based Viking Air has identified Brazil as the next sales target for its modernised version of the de Havilland Canada DHC-6 Twin Otter – the Series 400.

“Brazil is now the top priority,” says David Caporali, Viking Air’s recently-appointed regional sales director for Latin America.

Since restarting production in 2011, Viking Air has made successful sales drives into Russia and more recently China, where the Reignwood Group has signed a major order for 50 Series 400s.

Brazil is seen as another huge market opportunity for the high-winged, 19-seat aircraft, which offers short take-off and landing capability.

At the peak of the DHC-6’s original success from the late-1960s to the mid-1970s, the Brazilian market was off-limits, as the then-state-owned Embraer produced a rival 19-seater in the EMB-110 Bandeirante. Embraer has since moved on to other sectors of the



An Amazon-based operator will act as local sales representative

aviation market, and now the Brazilian government operates dozens of ageing Bandeirantes that may soon need to be replaced.

Viking has been active in the greater Latin American region since 2011, selling Series 400s into Chile, Panama and Peru, and also signing deals to support older Twin Otters operated in Argentina. The company recently signed up five sales representatives to operate around the region – but not until very recently in Brazil.

Last February, Viking Air hired Caporali to lead sales efforts across the region and, in particular, to introduce the Series 400 into Brazil. He had previously managed sales for former Beechcraft dealer Lider Aviacao in the country.

Caporali does not expect the Brazilian market to open up to the Series 400 immediately. The economic crisis facing the Brazilian government could slow interest in replacing the

EMB-110 fleet, and government officials still know little about the capabilities of the Twin Otter, he says.

The Series 400 which made the type’s debut appearance at the show on 11 August represented the only Twin Otter in the country, and Caporali notes: “We need to show the capabilities of the aircraft.”

Meanwhile, Viking Air has announced that an Amazon region operator, Manaus Aerotaxi Participacoes (MAP), will function as its sales representative for the Series 400 in Brazil.

MAP currently operates a diverse fleet of aircraft, including the Bandeirante, Aero Commander, Cessna Caravan and Embraer Xingu, as a taxi service for passengers and freight in the Amazon – and performing many of the roles that Viking envisions for a Twin Otter.

The company’s involvement “brings attention for all operators that do these operations the most,” says Caporali. ■

DEVELOPMENT

Testing resumes on G500 after flutter preparation

Flight testing has resumed on Gulfstream’s G500 after a break of “several weeks” to prepare the large-cabin, long-range business jet for flutter tests, the company announced on 10 August.

The G500 underwent a number of modifications, says Gulfstream, including the installation of winglet and horizontal flutter vanes and the aircraft’s attitude recovery chute. “During the modification period, Gulfstream used simulators to help our pilots prepare for the flutter tests,” it adds.

After initially revealing the project on 14 October last year, Gulfstream flew the G500 for the first time on 18 May. The 5,000nm (9,250km) range, large-cabin jet has so far accumulated 15 flight

test hours, including one flight lasting 4h. The flight-test campaign has made progress clearing the type’s initial flight envelope, covering altitudes up to 38,500ft and achieving a top speed of Mach 0.8, the company says.

The G500 and larger, follow-on aircraft the G600 are also undergoing a battery of testing in a

ground laboratory, with more than 36,000h completed to date. Gulfstream has also activated an iron bird test rig and integrated test facility for the latter.

“The first five flights exceeded our expectations, and they demonstrated that our testing facilities on the ground are having very real benefits in the air, allowing us to

identify and address issues before they’re ever seen in flight,” says Dan Nale, senior vice-president of programmes, engineering and test for Gulfstream.

Both aircraft types are packed with advanced technologies. In addition to full fly-by-wire flight controls, Gulfstream has inserted active sidesticks developed by BAE Systems, providing real-time feedback to flight crew control inputs.

The G500, which is powered by two Pratt & Whitney Canada PW800 engines, is scheduled to enter service in 2018 after receiving type certification from the US Federal Aviation Administration in 2017. Entry into service for the G600 is scheduled to follow during 2019. ■



The large-cabin business jet has undergone several modifications



Searching for
better ELT
performance
NEWS FOCUS P28

ROTORCRAFT DOMINIC PERRY LONDON

Troubled waters for offshore industry

A longer than anticipated downturn in the oil and gas market is forcing helicopter operators to make deep cost savings

Reduced activity in the oil and gas industry is continuing to weigh on operators in the offshore transportation sector, with those on the front line particularly hard hit.

There had been hopes the price of crude oil would recover as the year wore on, but recent developments, particularly the rapprochement with Iran, have dampened that optimism. Brent crude is currently trading at around \$50 per barrel, down from a recent high of over \$58 per barrel in early July.

Those issues are highlighted by the financial results of major operator Bristow Group. During the three months to 30 June it swung to a net loss of \$1.62 million compared with a net profit of \$45 million for the same quarter a year earlier.

WORSE TO COME

Oil and gas revenues were hardest hit, falling by 8% year on year, as producers reined in spending. And, says chief financial officer John Briscoe, that situation will worsen, with full-year segment revenues forecast to fall by 10-15%.

What has particularly hurt Bristow has been its inability to shrink its cost base fast enough to cope with the declines in activity.

"The downturn has been felt globally, but our North Sea operations have been particularly impacted"

JONATHAN BALIFF
Chief executive, Bristow

In fact, says Jeremy Akel, chief operations officer, efficiencies sought by the oil producers through improving the load factor on each flight, changed rotation patterns of the offshore workforce and "more resilient scheduling" are all "driving the overall demand [for flights] downwards", he told analysts on a 7 August conference call. "We believe there is a new normal coming," he predicts.

Bristow had originally planned for a 12-24-months downturn, but is now revising this to 36 months with no recovery anticipated before the back end of 2017.

As a result, it is accelerating cost savings across the business. It had already committed to taking \$95 million out of the operation in its 2016 fiscal year – including reducing its workforce by 10% – but will look for additional economies of \$60 million over the next 12



Staff reductions are planned at Bristow's Aberdeen operation

months, which will encompass "further headcount reductions".

The pain is likely to be most keenly felt in Europe, as chief executive Jonathan Baliff points out: "The downturn has been felt on a global scale, but our North Sea operations have been particularly impacted in recent months."

As a result, UK subsidiary Bristow Helicopters in July began consultations to make 130 staff redundant – including 66 pilots – from its Scottish operations. It is not alone – rival CHC Helicopters is also cutting 50 pilots and engineers at its Aberdeen base.

The third of the big North Sea operators, which trades as Bond Offshore Helicopters in the UK and Norsk Helikopterservice in Norway, also appears to be feeling the pinch. During a trading update on 30 July, parent company Babcock International forecast 2015 revenues for its oil and gas operations will see a "double digit" decline in 2015.

REGIONAL VARIATION

The financial pain felt by operators is not confined to the North Sea. In its quarterly results for the period to 30 June, Louisiana-based PHI, which serves oil producers in the Gulf of Mexico, reported oil and gas revenues down to \$113 million from \$128 million a year earlier.

But not every operator is feeling so negative. Despite underlying revenue and profit slipping in the quarter to 30 June on "lower utilisation" of its medium helicopters, US-based Era Group is staying upbeat.

"To paraphrase Mark Twain, reports on the death of the Gulf of Mexico offshore market have been greatly exaggerated, at least as it relates to helicopter services," says Chris Bradshaw, Era's chief executive and chief financial officer, calling it "one of the best, if not the best offshore helicopter market in the world". ■

MANUFACTURING

Airframers feel the pinch as orders and deliveries drop

Helicopter manufacturers are also seeing weakness in the sector translate to lower orders and deliveries, particularly at the larger end of the market.

Airbus Group chief executive Tom Enders warned on 31 July that the state of the oil and gas market is "not helping" sales of medium and heavy segments at its Airbus Helicopters division.

Similarly, AgustaWestland is encountering an unfavourable market which it partly blames on the "performance of the oil and gas sector".

Figures from the operators themselves show several cancellations and deferrals.

For example, PHI will take delivery of two heavy helicopters this year, almost certainly Sikorsky S-92s, dating from a 2014 commitment for six. However, in July it axed the remainder of the order.

And Era Group has trimmed its overall requirement for AgustaWestland AW189s from 10 helicopters to nine.

Bristow's fleet plan for the year remains broadly unchanged, but it has allowed six options – for four

medium-class helicopters and two heavies – to expire.

However, chief executive Johnathan Baliff insists that despite the depressed market, its order for 17 Airbus Helicopters H175s, placed in March this year, makes sense, not least that it included an airline-style uptime agreement offering significant "risk reduction".

The new class of super-medium helicopters, including the H175, allows it to offer clients "aircraft that are right-sized" to "maximise load factors", adds chief operating officer Jeremy Akel. ■



TECHNOLOGY STEPHEN TRIMBLE WASHINGTON DC

Searching for better ELT performance

Three US agencies are trying to develop more reliable emergency location transmitters to counter known weaknesses

The crash of a de Havilland Canada DHC-3 charter aircraft in Alaska five years ago on 9 August is remembered mainly for causing the death of US Senator Ted Stevens.

But the fatal accident soon focused the attention of safety investigators, aviation lawmakers and Stevens' fellow legislators on the failure of the emergency locator transmitter (ELT) to function properly, which delayed the rescue of five survivors – including then-EADS North America chief executive and former NASA administrator Sean O'Keefe – for several hours.

Now a joint effort by three US agencies – NASA, the National Oceanographic and Atmospheric Association (NOAA), and the air force – are trying to establish the criteria for more reliable aircraft ELT technology, which could inform a new specification being drafted by two standards organisations – RTCA in the USA and EUROCAE in Europe.

ELTs represent “a known weakness, we feel, in the system”, says Chad Stinson, NASA's project manager for the ELTSAR effort.

CRASH TEST

To understand why ELTs so often fail in general aviation crashes, NASA acquired three Cessna 172s for a special series of tests. Leveraging an A-frame steel structure originally built to test the Apollo lunar lander, NASA is purposely crashing the three Sky-

hawks, with each packed with multiple ELTs.

A test on 29 July destroyed a 1958-vintage Cessna 172, featuring the classic straight tail beloved by Skyhawk enthusiasts. It was loaded with five active ELT systems, raised by the A-frame gantry to a height of 100ft and then released for a nose-first plunge to the ground.

The data from the crash – detailing precise loads and how each of the ELTs performed – will help NASA validate a software model that could be used to run hundreds of accident simulations.

“People think if you're improving something it will cost more. In this case, a very cheap cable will do the job”

LISA MAZZUCA

Mission manager, SAR, NASA

In a rare lapse of aviation's tightly-regulated safety culture, even the most modern ELTs often fail to perform in a “survivable” crash. Precise numbers are difficult to pin down, but a 2012 NASA study – commissioned by Congress in the wake of the Stevens crash – estimated onboard ELTs do not alert rescuers in 50-60% of survivable accidents, Stinson says.

ELTs fail even when their installation conforms to the US



Vintage Cessna 172s were loaded with ELTs for crash testing

Federal Aviation Administration's latest standard, as highlighted in the crash that killed Stevens and three others.

The ELT device includes a beacon connected by cables to a satellite antenna. Both the antenna and the beacon survived the impact that killed Stevens. The ELT installation met the FAA's standard at the time, but the Velcro strap attachment did not contain the beacon, severing the cords connecting the device to the antenna.

In such cases, the existing ELT technology would be effective if the installation was better designed. “Manufacturers can meet all the requirements using the technology and components they already have,” Stinson says. “They just need to put more engineering into it.”

In other cases, the positioning of the ELT in the aircraft is the source of the problem. In the 29 July crash test of the Cessna 172,

NASA put two of the ELTs in locations required by the FAA, while, to test its assumptions, the other three were installed in spots that the agency believes could be more effective.

FIREPROOF CABLE

There are also cases in which a post-crash fire destroys the cable connecting the beacon to the antenna. NASA's research tested commercially available, thermally-coated cables that can survive exposure to flames for more than 20min. Despite only costing \$1 per foot, such equipment is rarely found in ELT devices.

“People think if you're improving something it has to cost more. In this case, a very cheap cable will do the job. But not all vendors are using it because they don't yet have specifications on what cable you are supposed to use,” says Lisa Mazzuca, NASA's mission manager for search and rescue.

NASA plans to submit a package of design recommendations in the second quarter of next year to the RTCA committee developing the new standard. The RTCA is expected to complete its work in 2017. Then it is up to the FAA to decide whether to allow the general aviation community to use the new standard as an option, or mandate that the industry convert to the updated ELT specification within a certain time period. ■



The Skyhawks were purposely crashed using a structure originally built to test the Apollo lunar lander



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RUSSIA AT A TURNING POINT

After several years that saw a new era of commercial orientation, structural reform and active Western collaboration bringing visible momentum into Russian aerospace, a combination of geopolitical tensions, economic pressures and changing markets have the industry facing urgent calls for improved performance



STRETCH TARGET

Originally conceived as the largest in a family of three, the first Superjet type could instead be joined by a longer variant, as Sukhoi faces up to stronger competition



The Superjet marked Sukhoi's first foray into passenger jets

STEPHEN TRIMBLE PARIS

Single-model product offerings are so rare in the commercial aircraft business that they usually represent a strategic miscalculation made somewhere at the beginning of an unexpectedly long development process.

The Sukhoi Superjet arguably makes a good example.

Launched 15 years ago as a replacement for the Tupolev Tu-134 and Yakovlev Yak-42, the original Superjet concept included a family of three products – a 60-seater, a 75-seater and a 95-seater.

As the development schedule dragged on, it became clear the 60-seat concept so popular in the late-1990s regional jet boom had fallen out of favour. By the time Sukhoi finally delivered the first operational product – and largest of the three original variants – in 2011, interest in completing development of the 75-seater had also dried up.

LARGER FOCUS

The Superjet family of aircraft is now back on the agenda, but the focus has shifted from smaller aircraft to a larger model. The Superjet NG also offers Sukhoi and the greater Russian industry a unique opportunity to improve aircraft performance.

The stretch project is currently in the preliminary research phase, Sukhoi deputy chief designer Alexei Dolotovskiy tells *Flight International* in an interview. He describes the status in mid-June as between gates 2 and 3 of Sukhoi's internal development process.

The original Superjet was proposed in 2000, a year after Embraer launched the first version of its E-Jet family. Thirteen years later, the 95-seat version of the Superjet had just entered service, but Embraer launched the second-generation of the E-Jet family with a new wing and new engines – the Pratt & Whitney PW1700G and PW1900G geared turbofans.

Sukhoi claimed a 6% cash operating cost advantage for the Superjet over the original E-Jet series. It would have to do something with the Superjet to respond to the improved performance of the E-Jet E2 series.

But Sukhoi also faced several constraints. Embraer has received orders for more than 1,000 E-Jets, creating a strong financial base to develop the improved version. Sukhoi has struggled to attract non-Russian buyers for the Superjet, with certain exceptions, such as Mexico's Interjet. But the Sukhoi programme lacks the financial power offered by the E-Jet series. The Superjet programme also fell deeply into debt, which was relieved earlier this year with a commitment from the Kremlin to invest in a nearly \$2 billion bail-out.

While the design for the stretched, so-

called Superjet NG does not start with a clean sheet of paper, Sukhoi is working on a package of major performance improvements that could alter the shape and lifting characteristics of the wing, exchange Western-based suppliers of systems and avionics with Russian firms, but possibly leave the powerplant largely the same; albeit slightly more efficient.

A 100-seat regional jet stands out in Sukhoi's traditional product portfolio, which consists exclusively of fighters and aerobatic aircraft. Until former Sukhoi and United Aircraft

“Compared with the existing product on the market, the SaM146 is better by 1-2%”

ALEXEI DOLOTOVSKI

Deputy chief designer, Sukhoi

chief executive Mikhail Pogosyan launched the Superjet programme, passenger aircraft were solely the domain of design bureaus such as Ilyushin, Tupolev and Yakovlev (now part of Irkut).

But the Superjet programme's association with the same designers responsible for high-performance fighters such as the Su-27 clearly had an effect.

The Superjet on paper boasts one of the most efficient wings for any commercial aircraft. By one standard measure of efficiency, the Superjet wing's aspect ratio is a highly respectable 10, equalled or exceeded only by aircraft such as the Bombardier CSeries and Boeing 787.

“We already know quite well the Bombardier product. We are looking at the new generation Embraer product. But I believe it will be quite close to the aspect ratio level already achieved. So it is between 10 and 11. I do not think Embraer will take the risk to increase the aspect ratio to more than 12,” Dolotovskiy says.

“You know there is a big research activity in the aviation industry now to find a solution to buffeting to increase the efficiency of the wing,” Dolotovskiy says. “And there is a goal after 2020 just to find a preliminary technical solution which could be recommended in industry to be used for advanced projects after 2020. So in this direction there is no way to increase the lift over drag ratio from my point of view for close to 20 years.”

INCREASING STRENGTH

For the stretched model, Sukhoi is considering ways to slightly improve the performance of the wing, but such a task is complicated. Making the wing more efficient has the effect of increasing the aerodynamic loads, which, in turn, requires the designers to increase structural strength from the wingtip to the torsion box where the wing meets the fuselage.

SALES STEPHEN TRIMBLE MOSCOW

JURY STILL OUT ON SUPERJET 100 PROGRAMME

SUKHOI CIVIL Aircraft's (SCAC) Superjet programme seemed on the brink of financial calamity entering 2015.

A slow-starting production system had already produced a series of annual losses and an overall debt of about \$2.5 billion. On top of that, the plummeting value of the Russian rouble only served to increase the cost of the Superjet 100's imported aircraft systems.

By late January, the Fitch Ratings agency had lowered Sukhoi Civil Aircraft's debt to the top tier of its non-investment grades, but warned that even a "perceived waning" of support from the Russian government for the Superjet programme could sink its rating even lower.

It soon became clear that the Superjet's supporters had little to fear. The 86-seat regional jet remains critical to the Russian aviation industry's hopes of regaining its Soviet-era foothold in the global market for commercial aircraft. By late March, Russian president Vladimir Putin had committed to inject Rb100 billion (about \$2 billion) into SCAC, relieving the United

Aircraft (UAC) subsidiary of a crippling debt load at a critical moment.

The \$2 billion investment "gives us confidence in the future of the programme and gives us additional leverage in financing and developing the programme further", UAC chief executive Yuri Slyusar told *Flight International* in a recent interview.

"First of all, of course, the investment will be channelled to ease the existing credit burden, which is negatively affecting the manufacturing cost," he adds. "Some part will be devoted to potential investment in technical areas."

Fifteen years after Russian design bureau Sukhoi launched development of the small narrowbody, the Superjet is still balanced precariously between programme failure and success story in a perennially unpredictable market segment.

LAGGING BEHIND

Flightglobal's Ascend Fleets database lists 66 aircraft delivered four years after entry into service, with firm orders for 115 aircraft remaining in the backlog, plus options to purchase another 15 and signed

letters of intent to buy a further 77.

By comparison, Embraer launched development of the E-Jet family only a year before Sukhoi started on the Superjet but has produced four variants and delivered more than 1,110 aircraft.

"We are currently thinking in two major directions of this family development"

YURI SLYUSAR

Chief executive, United Aircraft

That disparity in sales comes in spite of several advanced technologies embedded in the Superjet design. In a different era of industrial and political co-operation, Boeing consulted with Sukhoi on the design of the Superjet. Alenia Aermacchi, meanwhile, contributed its own certification expertise and relationships with the European Aviation Safety Agency and the US Federal Aviation Administration, and took a majority stake in the SuperJet International joint venture tasked with marketing the aircraft outside of the Russian and Asian markets.

The Superjet emerged from that collaboration with a host of Western technologies, including a fly-by-wire flight control system designed by Liebherr, Thales-made integrated avionics and a high-pressure-ratio engine core provided by Snecma.

From a marketing standpoint, what the Superjet still lacks is a family of larger and smaller aircraft. Embraer offers four versions of the current E-Jet and Bombardier has three options between 70 and 100 seats. SCAC still offers only one option with 86 seats in a standard, two-class configuration.

Now that the Russian government has eased SCAC's debt burden, revisiting proposals to expand the Superjet product portfolio are high on the agenda.

SLOW ADAPTATION

"We are currently thinking in two major directions of this family development," Slyusar says. "First is shrinking or extending passenger capacity from 75 to 130. The second major direction is technical improvement in numerous ways. Basically, we had to have some time after the basic model entered the market to evaluate what is most needed, and then to slowly adapt this basic model to improve it."

The market for the Superjet is not



The SSJ100's order backlog includes 115 firm commitments

Sukhoi

» "We have good experience with the torsion box we designed for that aircraft, so we have found an ability to increase a bit the aspect ratio," Dolotovskiy says. "So we expect to increase the lift-to-drag ratio level several percent in comparison with the current aircraft."

If the wing can be made more efficient, the stretched Superjet will improve on an already impressive lift-to-drag ratio of 16.5. Due to Reynolds number effects, large aircraft, such

as a widebody, can achieve higher lift-to-drag ratios. Among its narrowbody siblings, however, Sukhoi believes it can achieve a standard in lift-to-drag ratio with the stretched Superjet approaching 18.

"We will see. But we have the preliminary result in the high-speed wind tunnel at [the Central aerohydrodynamic research institute – TsAGI], and it's promising," Dolotovskiy says.

The aerodynamic improvement is expect-

ed to deliver other benefits. A stretched model is expected to be heavier than the roughly 50t maximum take-off weight (MTOW) of the original product. In this case, Sukhoi is hoping to contain the MTOW of the stretched model to under 55t; or less than 10% more.

The standard formula for calculating the distance an aircraft can fly – popularly known as the Breguet range equation – establishes



Four years after entry into service, 66 Superjet 100s have been delivered



static. It was developed in the same class of technology as the Bombardier CRJ700/900/1000 and E-Jet family. In three years, Embraer plans to deliver the second-generation E190-E2 with a more efficient wing and the Pratt & Whitney PW1900G geared turbofan engine. It could make SuperJet International's task much more difficult to expand the market for the Russian aircraft in the West.

So far, UAC has discussed plans to introduce winglets and reduce the weight of the Superjet, but the possible launch of a 130-seat version offers an opportunity to make more dramatic improvements.

The focus of any major upgrade would have to include the engine.

"First of all, the investment will be channelled to ease credit burden"

YURI SLYUSAR
Chief executive, United Aircraft

The Superjet 100 uses PowerJet's SaM146. It features a low-pressure section contributed by NPO Saturn, a subsidiary of United Engine (UEC), and a high-pressure section developed by Snecma. The high-pressure module was derived from Snecma's Dem21 demonstrator core, and features a six-stage high-pressure compres-

sor and a single turbine stage.

UAC delivered basic performance parameters for a potential 130-seater to its engine supplier a year ago.

ENGINE DECISION

"Together jointly with Snecma we made a preliminary investigation of what it would take to modernise the SaM146, and so it is possible to make an engine based on SaM146 for this aircraft," said Vladislav Masalov, UEC's chief executive, in a recent interview.

UAC's requirements for the 130-seat aircraft are not fixed, so the PowerJet consortium developed two options. The first option is a "light" upgrade programme involving an improved version of Snecma's full-

authority digital engine control system and a 3% thrust increase. A larger modernisation is also proposed that includes upgrading the engine core and low-pressure section, Masalov says.

If more fuel efficiency is required for the Superjet to compete on an even basis with a new class of regional jets powered by geared turbofans, Masalov says, UEC can provide another option.

Another UEC subsidiary, Aviadvigatel, is developing the high-bypass PD-14 engine as a Russian-designed alternative to the P&W geared turbofan for the Irkut MC-21, a narrowbody in the same class as the Boeing 737-800 and Airbus A320. ■

range as a function of wing area and thrust for a given weight. As the weight of a stretched model increases over the original, the designer must either improve wing efficiency, thrust, or some combination of both.

For the stretched Superjet, Sukhoi is aiming to emphasise wing area over dramatic changes in the thrust requirement.

The current Superjet is powered by the PowerJet SaM146, a product of a collaboration

between France's Snecma and Russia's United Engine Corp.

"If you compare our engine with the existing product on the market, which is the [GE] CF34, in terms of specific fuel consumption the SaM146 is better by 1-2%, which is a lot," Dolotovskiy says. "This engine is based on the technologies and the philosophy – from my point of view philosophy is much more important in terms of design because technolo-

gies change but philosophy is a way of thinking – it is very reliable, very maintainable. It is friendly to the ground staff. And it is very robust to the heat injections."

In considering options for powering the stretched Superjet, Sukhoi has closely studied the Pratt & Whitney geared turbofan engine, which is selected to power the Airbus A320neo, Bombardier CSeries, Embraer E-Jet E2 and the Mitsubishi Regional Jet. Russian

» industry also has deep insight into the engine's capabilities through P&W's selection by Irkut to power the MC-21.

"It's a really big challenge from the P&W product. We respect these engine people. To increase bypass ratio by using a gearbox, by creation of the new more efficient core. It's a really interesting product and we look at that product," Dolotovskiy says.

"We'll also keep the fly-by-wire system because it is outstanding now"

ALEXEI DOLOTOVSKI

Deputy chief designer, Sukhoi

Sukhoi's analysis has concluded that the geared turbofan engine's fuel efficiency advantages are real, but they come for a price. By retaining the SaM146 powerplant, Sukhoi hopes to offset the fuel efficiency improvement offered by the P&W product with a steep price discount on acquisition cost.

"I'm not sure that Pratt & Whitney engine will cost exactly the same as SaM146 for instance," Dolotovskiy says. "And I'm not talking about maintenance. I'm just talking about cost itself. So then you will compare. I have got aircraft number one and aircraft number two. The [P&W-powered] aircraft is 10% more efficient – yes, it's more fuel efficient. But if you take the full economic analysis, at least [the SaM146-powered aircraft] will become comparable. At least."

The improved wing surface of the stretched model also plays a critical role in Sukhoi's analysis of the thrust requirement. By using the more efficient wing, the heavier stretched Superjet should be able to meet take-off and range requirements with only a small improvement



Mexico's Interjet is one of the few exceptions in Sukhoi's mostly Russian order book

in thrust compared to the original version.

"We found a technical solution to keep the same engine. We have the same thrust rating," Dolotovskiy says.

FACING COMPETITION

In addition to the E-Jet E2, Sukhoi's stretched model will compete in the same cabin segment as the CSeries, including the 110-seat CS100 and 135-seat CS300. The CSeries and the Superjet share obvious similarities, with five-abreast, economy-class cabins.

The CSeries is a formidable rival for Superjet. "It's a nice aircraft, I like it," Dolotovskiy says. "It looks like a Superjet."

But Sukhoi is careful about promising too much for the stretched Superjet. The CSeries,

for example, is offered with more than 3,000nm (5,550km) range, a trans-continental distance rivaling the Airbus and Boeing narrowbody families. Sukhoi, however, plans to limit the range of its proposed commercial product to less than 2,000nm.

The stretched aircraft will be "suitable for regional operation with optimised costs", Dolotovskiy says. "We would not like to make a universal aircraft. History shows if you're trying to be the best everywhere, you will never be good anywhere. We are focusing on the regional market. We would not like to have Airbus and Boeing as competitors."

Another part of the planning phase for the Superjet NG is the study of future avionics requirements. If the Superjet NG enters service after 2020, it will be subject to several new requirements for airspace access imposed by the USA's NextGen and Europe's SESAR air traffic modernisation programmes.

"So we expect to use this opportunity to give the same cockpit for both family members, but with some advantages," Dolotovskiy says. "We'll keep our five-screen system because it looks nice, and it is positively accepted by the pilot. We will keep the general shape of the cockpit and the general functionality, for sure. We also keep the fly-by-wire system because it is outstanding now. But maybe we will grow some capability for the avionics suite in accordance with the requirements."

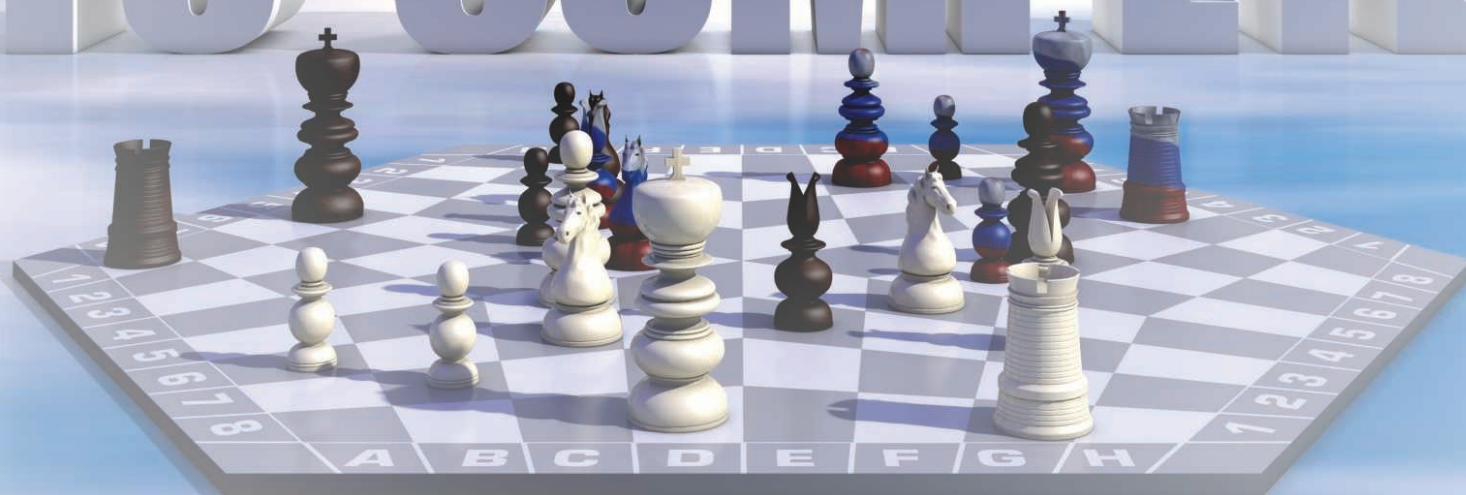
A head-up display (HUD) is expected to be mandated for all commercial aircraft operating in China by 2025. A Chinese lessor has recently become a major Superjet customer, committing to acquire 100 aircraft. "We will consider a HUD for the Superjet 100, especially for the Chinese market," Dolotovskiy says. ■



The stretched variant gives Sukhoi the chance to make improvements over the first type

To compete in the world market we did a major step forward having accumulated the best industry resources and outstanding engineering expertise in a single corporation. The integration brings us strength to offer the market the best innovative solutions in the balanced product lines in commercial, military and transport aviation. In the challenging environment we grow open and build strong partnerships with the world industry leaders. We never stop nourishing fresh ideas and young talents who dare to look in to the future.

TO COMPETE





Sanctions have so far had no impact on the MC-21 supply chain, but pressure is on local majors to have greater involvement in commercial programmes

STEELY AMBITION

Irkut president Oleg Demchenko knows the MC-21 faces formidable competition, but the ambitious company is working hard to make its mark on the narrowbody market

STEPHEN TRIMBLE MOSCOW

Do not question Oleg Demchenko's ambition. As the president of Irkut, the executive is leading a Russian company with little track record in the commercial market into a sector already dominated by Airbus and Boeing.

Though some might still accuse the head of Irkut of being wildly ambitious, Demchenko contains his ambition to a set of more practical goals. It is not commercial parity that Irkut seeks against Airbus and Boeing with the MC-21 family of narrowbody airliners, but a strong foothold in a steadily growing, global commercial market.

"It would be funny if I said we would get 40-50% of the market. This would not be serious talk. If I said something like that, my colleagues wouldn't shake hands with me," Demchenko says.

But even fractions of the global narrow-

body market are worth pursuing, as Airbus and Boeing deliver more than 1,000 A320s and 737s combined each year. Irkut's sister design bureaus, Ilyushin, Tupolev, Yakovlev and more recently Sukhoi, have had past success in the narrowbody market. Irkut now hopes to reclaim a share of that glory with an MC-21 aircraft design produced with the Yakovlev design bureau.

"If our aircraft takes 10-15% of the market, it means my life in aviation – and all my life



The MC-21's first flight is expected in 2016

has been in aviation, as the director of the company – I would say I did not waste my time," Demchenko says.

The MC-21 is less than three years from entering service, so for now he takes comfort in a respectable order backlog that includes 175 firm orders.

"OK, I am not Airbus," says Demchenko, perhaps referencing the nearly 3,800-order backlog of the A320neo family. "But for an aircraft which is still on paper, and this our first try to enter the market with this kind of aircraft, this is not bad. The most important task for us right now is to start our flight test."

Flight testing is on track to begin in 2016 on a revised schedule. Irkut's original plan called for first flight in 2014 to support an entry into service in 2016.

"There is no aviation programme around the world which could fulfil the original schedule," Demchenko notes. "There is always a delay. This is a very difficult titanic



“If our aircraft takes 10-15% of the market... I would say I did not waste my time”

OLEG DEMCHENKO
 President, Irkut

task, you know. This is really hard labour.”

The challenge for Irkut includes not only the strategic confrontation with Airbus and Boeing. To make the MC-21 attractive to customers in an already hotly-contested market, Irkut committed to a suite of advanced technologies to make the aircraft's performance as attractive as possible. The basic technology for some selections, such as Pratt & Whitney's PW1400G, has been proven on other programmes. But Irkut decided to be an industry pioneer in some areas, particularly a new kind of weight-saving composite technology.

Airbus and Boeing have long-established composite manufacturing processes, but still use autoclaves to cure the carbonfibre reinforced plastic resin found in load-bearing structures of commercially certificated aircraft.

But Irkut has leapfrogged that approach on the wingbox, wing panels and wing spars for

the MC-21, using lower-temperature and less complex ovens to cure the resin. Irkut partnered initially with Austria's Diamond Aircraft and FACC to build the first prototypes with the assistance of Russian supplier AeroComposite. The role played by Diamond and FACC has ended, but AeroComposite and Irkut continue to make progress in early testing.

Demchenko is well aware of the risks of introducing an all-new structural technology in a new aircraft.

“Some people are trying to explain to me that I am making a mistake because the risks are very high. Yes, the risks we are taking are very high. But if I try to plan my aircraft from the very beginning with a metal wing I wouldn't be able to sell a single aircraft,” Demchenko says. “If we want to be competitive in the market, the quality of the aircraft should be different than the existing aircraft. Of course, when we are talking about these new technologies not all of them are developed and assessed and evaluated.”

The MC-21 was launched with significant contribution from Western suppliers. So far, neither sanctions imposed by Western governments nor a recent push by Russian government and industry officials for more local industry content has altered the supply chain. But pressure is growing as local companies, such as KRET and Technodynamics, appeal for greater involvement in such programmes. KRET and Technodynamics represent the Russian equivalent of Western Tier 1 suppliers such as Rockwell Collins, Thales and Honeywell. Each has vast experience on military programmes, but less participation in commercial aircraft designed to meet Western certification standards.

MEETING REQUIREMENTS

According to Demchenko, Irkut's policy is to consider all such proposals, but the aspiring Russian suppliers must prove they can pass certification requirements in order to participate in the programme.



The first aircraft to emerge from Irkut's factory is expected to be the 180-seat MC-21-300

“Our project is an open one,” Demchenko says. “Our Russian companies will be able to produce equipment with our technical requirement specification. So we shall perform the aircraft tests with those products. Why not?”

Although the supply chain remains open, Irkut's product strategy is tightly focused at the moment. The first aircraft to emerge from its Irkutsk factory will be the 180-seat MC-21-300. It will be followed by the debut of the 150-seat MC-21-200. There were also plans for a 220-seat MC-21-400 to complete the family, but Irkut has shelved that plan. Although customer interest in a Boeing 757 replacement is heating up – and the original design for the MC-21-400 more closely matched the 757's size than Airbus' and Boeing's nearest rivals – Irkut remains focused on the MC-21-300.

“We have chosen the -300 as the starter,” Demchenko says. “We are new players in the market. So now we have invested all our effort in the -300, so the customer should be confident in our efficiency and our capability to build and deliver the aircraft.” ■



MC-21 cockpit: Irkut has focused on making the aircraft attractive in a hotly contested market



The Frigate Ecojet's unique oval fuselage could give airlines the opportunity to replace two closely spaced narrowbody operations with a single flight

GETTING IN SHAPE

On the verge of relocation to aid development, start-up Frigate Ecojet hopes to entice the market with its unique widebody concept

STEPHEN TRIMBLE MOSCOW

Launching a three-aisle widebody airliner with a geometrically unique, oval fuselage cross section always seemed an uphill struggle for a start-up Russian manufacturer, but the challenge in the end proved overwhelming.

"It is impossible to develop and create this kind of aircraft here," says Sergey Grachev, director of marketing sales for Frigate Ecojet, a subsidiary of the Rosavia consortium.

The problem was geographic, not technical.

Despite a nearly 25-year relationship with Russian industry, Frigate Ecojet is moving out of Moscow and relocating to a still-undisclosed city in Europe. There, it plans to complete the definition phase for the medium-haul, widebody airliner, launch production, undergo certification testing with the European Aviation Safety Agency and begin deliveries.

NEW SEGMENT

If the plan succeeds, this renamed and updated concept originally launched by Tupolev as the Tu-304 in the early 1990s will open a whole new market segment for air transport in the early 2020s.

The business case for the aircraft has not

changed. More than half of Airbus A330 and Boeing 787 fleets are operating routes under 2,000nm (3,700km), but are optimised to fly more than 6,000nm. This means the aircraft are heavier than necessary for the majority of their routes, Grachev says.

Specifically, the average annual cost for one metric tonne of aircraft is \$140,000. This simple calculation drove Tupolev designer Victor Klimov in the early 1990s to design the Tu-304. Its oval cross section is wide enough to accommodate 10-abreast seating in the economy cabin with three aisles. That allows it to carry as many passengers as an A330-300, but weigh 17t less with the fuselage length of an A310-300.

The trade-off for the reduced weight is lower range. Frigate Ecojet is aiming to achieve a maximum range of slightly less than 2,000nm.

The vast difference in range performance could work to Frigate Ecojet's advantage, Grachev says. It has no ambition to compete against Airbus and Boeing head to head. The goal is to persuade airlines to view the oval airliner as a complementary asset to their existing widebodies, rather than a direct competitor.

Grachev also proposes that airlines could replace two closely spaced narrowbody operations with a single flight by the Frigate Ecojet.



The concept features a three-aisle cabin

"If you change two close flights for narrowbody for one aircraft like this you dramatically lower the cost of seats," he says.

It is no secret which widebody manufacturer Frigate Ecojet hopes to emulate the most. To help keep training costs low for airlines, it plans to seek a common type rating from EASA with another widebody. Grachev declines to identify which, but notes that the Frigate Ecojet cockpit includes a sidestick control. That appears to align the type rating with an Airbus cockpit.

LONG ROAD

The company faces a long development period. It was expected to finalise the conceptual design by mid-year, the move into the definition phase. It is still on track to complete first flight in 2018 or 2019 and reach entry into service in 2021, Grachev says.

Answering the question why Frigate Ecojet must leave Moscow is less straightforward for Grachev. "For you to best understand, I need at minimum three hours" to explain, he says.

But the move is essentially driven by the wide gulf in certification standards between Russia and EASA, which shares a bilateral agreement on type certification with the US Federal Aviation Administration.

Russian certification standards are not yet fully harmonised with airworthiness requirements set by EASA and the FAA. As a Moscow-based company, Frigate Ecojet is required to seek certification first by Russian authorities, then re-do at least 30% of the certification testing for EASA, he says. However, if it is based in Europe, it can apply directly to EASA for a type certificate first, with relatively little additional work required to receive a reciprocal agreement from the FAA. ■

PLAYING CATCH-UP

The PD-14, designed to power the Irkut MC-21, marks Russia's attempt to open a new front in the commercial engine market, with a China tie-up firmly on the cards again

STEPHEN TRIMBLE MOSCOW

Perhaps most famous for designing a 60-year series of legendary fighter engines, Russia's engine industry – dominated by Rostec subsidiary United Engine (UEC) – is trying to rapidly catch up to four decades of Western development of high-bypass turbofans for commercial applications.

That ambition has already produced a locally-designed rival called the PD-14 to power the Irkut MC-21, and may lead to a revived partnership with China's emerging jet engine industry.

A full-scale engine that made its debut in the exhibit hall of the MAKS air show two years ago was labelled a technology demonstrator and emblazoned with serial number 100-01. In fact, that engine – representing the indigenous alternative to the Pratt & Whitney PW1400G for the MC-21 – actually stopped short of qualifying as the first engine to test for the PD-14 programme.

After the example was shown at MAKS, UEC subsidiary Aviadvigatel made a variety of undisclosed design changes. A new technology demonstrator was assembled in 2014 as the engine entered an "intensive test programme", former chief executive Vladislav Masalov says.

"This year it is very critical and important because industry has started to make the engines," he adds. "Now we have an engine that

is manufactured with serial technologies."

Engine numbers seven through 11 are scheduled to be assembled by the end of the year to be inducted into the certification test programme. Engine type certification is scheduled in 2017 and entry into service on the MC-21 is scheduled for 2018.

The PD-14 represents the future of Russian commercial aircraft propulsion. It follows the highly successful PS90 high-bypass turbofan engine that began testing 23 years ago, and adds a host of new technologies, including a hollow titanium fan blade.

BUSINESS PLAN

With the PW1400G as the alternative, Aviadvigatel faces a formidable competitive challenge, but the Russian supplier sees a variety of opportunities. It launched the programme with a business plan to sell over 200 PD-14 engines for the MC-21 through 2030, Masalov says. "Of course there are more optimistic and more pessimistic views, but this is a very realistic plan, and now we have already signed a contract with a company that belongs to state company Rostec for 70 engines."

The PD-14 is also likely to be the natural choice for Russian government and military customers of the MC-21. But Masalov cautions the government has not yet made a decision.

"We concentrate on the core, which can then be made into a bigger or smaller engine"

VLADISLAV MASALOV

Former Aviadvigatel chief executive

As the first new commercial engine core developed in two decades, the PD-14 will be likely asked to adapt to a variety of applications. Spinning off PD-14 technologies to improve the performance of a future Sukhoi Superjet engine is one possibility. But the engine architecture could also be stretched to serve the requirements for larger aircraft types. Aviadvigatel has discussed options for a 36,000lb-thrust-class (160kN) version, dubbed the PD-18.

"Of course, we considered PD-14 as a family of engines," Masalov says. "We concentrate on the engine core, which can then be made into a bigger or smaller engine. And then we have preliminary operating information from the state's operator from the ministry of defence that the [36,000lb] version can be used for medium transport aircraft."

The PD-18 is also a candidate to support a collaboration with India to develop a multi-function transport aircraft, he adds.

"I must note that there is a need for a large engine – 30t-35t-thrust [60,000-70,000lb-thrust] – maybe it will be for widebody aircraft, maybe it would be independently of a Russian-Chinese airframe," Masalov says. "Recently, research done in research institutes and United Aircraft Corporation for an engine of this thrust class [suggests] either a geared or non-geared fan."

UEC has agreed to launch a technical assessment of China's latest commercial turbofan engine development project that could lead to a new industrial collaboration with Russian industry. UEC and its Chinese counterpart took the decision at a meeting with Avic Aviation Engine Corporation last November at the Zhuhai air show, Masalov says.

The study will focus on the design details of the CJ1000 engine, which is the Chinese competitor to the CFM International Leap-1C. Both engines are being developed to power the 150-seat Comac C919 commercial narrowbody. If the study determines there are opportunities for Russian technologies to improve the CJ1000, UEC could propose to collaborate with China to provide those components, Masalov says. ■



The PD-14 would be an indigenous alternative to the Pratt & Whitney PW1400G for the MC-21



Alexander Rubtsov: the Russian and Ukrainian industries "cannot live without each other"

Ilyushin Finance

COMPLEX DECISIONS

Ilyushin Finance has had a tough year, exacerbated by its main customer base being forced into fleet cutbacks, and there are still plenty of challenges to overcome

STEPHEN TRIMBLE MOSCOW

Only a year ago Ilyushin Finance seemed in a very different position. A longstanding debate about its mixed ownership structure was finally poised for resolution. Negotiations remained active last summer with Bombardier about a proposal to buy 100 locally-built Q400 turboprops, as the Russian lessor waited for CSeries deliveries to begin in mid-2015.

But 12 months later Ilyushin's split-ownership structure has only been adjusted slightly, with the biggest issue left unresolved. The Q400 deal has collapsed, with Ilyushin Finance now involved in plans to revive the Ilyushin Il-114 regional turboprop or perhaps partner with China's Xian Aircraft to import or locally source the rival MA-700. The lessor is also re-evaluating its order for 39 CSeries aircraft.

Meanwhile, Ilyushin Finance's key customers – mostly Russian airlines – are facing a financial crisis caused by a depreciating rouble that is forcing fleet cutbacks just as suppliers – mainly Russian manufacturers – count on the

lessor to place dozens of orders for Sukhoi Superjets and Irkut MC-21 narrowbody aircraft.

"This is our life," says Ilyushin Finance (IFC) director general Alexander Rubtsov, only half-jokingly.

LACKING CLARITY

Ilyushin Finance was established in 1999 as Russia's answer to manufacturer-owned asset management companies, such as Boeing Capital Corporation. But it was not created with the same clarity of ownership as many of its comparable Western entities. United Aircraft Corp (UAC) is the biggest shareholder, with a 49% stake. Vnesheconombank (VEB) has the second-largest stake, at 21%. The split ownership highlights Ilyushin Finance's sometimes awkward triple mandate to act as an aircraft lessor, promote the sale of Russian-made aircraft and also be a successful business.

"We have been established by private investors, a government bank and manufacturers of aircraft not only as a company to make money but also to promote the sale or lease of newly developed types," Rubtsov says.

Some of that complexity was expected to be resolved last year, with reports of a potential deal by UAC to divest its ownership stake to VEB. Ilyushin Finance would lose the corporate parent of its namesake, but gain a single-minded ownership structure. As late as last January, it appeared the deal was poised to be signed, as UAC's board of directors authorised the sale of the 49% stake to VEB. But the deal was never consummated.

"It never happened because VEB had a choice either to acquire shares of IFC or to acquire shares of Sukhoi. At that time they opted for Sukhoi shares," Rubtsov says.

It once appeared likely that Ilyushin Finance would be rebranded to reflect its new ownership structure, but that talk has ceased.

"For us we have a very excellent relationship with UAC and a very good relationship with VEB," Rubtsov says. "So it's not a very big deal."

UKRAINE CONCERNS

Rubtsov also downplays the impact of tensions with Ukraine on the lessor's position as the largest buyer of Antonov An-148/158 regional jets, with 16 delivered. Although designed in Ukraine, they are assembled with 60% content from Russian suppliers, Rubtsov says.

"We cannot live without each other. We have industrial links for years and years and years," he adds.

The financial situation with Russia's airline industry is also not as bad as it may seem, Rubtsov says. He agrees the country's financial crisis is causing turmoil for domestic airlines. But the two airline bankruptcies so far – involving Polet and Vladivostok – had deeper roots.

Russia's commercial aircraft manufacturing industry has also received a reprieve. The Superjet entered the year more than \$2.5 billion in debt. But Russian government officials agreed in March to invest about \$1.8 billion, reducing debt to normal levels. The government also agreed to provide a further roughly \$500 million to subsidise Superjet aircraft leases.

The Superjet's declining debt is expected to spur a round of performance upgrades. But Rubtsov also has high ambitions for a next generation aircraft with 135 seats and a new engine.

Ilyushin Finance is also signed up as a major MC-21 customer, but Rubtsov has concerns about Irkut's ability to execute the programme. If it should falter, Rubtsov is keen to promote a re-engined Tupolev Tu-204 as an alternative.

The most immediate portfolio decision facing Ilyushin Finance is how to proceed with the CSeries. Rubtsov was counting on a financing package from the Export Development Canada bank. However, the Canadian government has prohibited such deals due to sanctions. Rubtsov is also concerned that CSeries delays erode the business case for using the aircraft as a stepping stone for the larger MC-21, which is scheduled to enter service a year later. ■

YAK-130

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UNITY IS STRENGTH

Recently appointed to head up Russia's United Aircraft, Yuri Slyusar is tackling the challenge of a new economic environment – and must rescue the Superjet programme

STEPHEN TRIMBLE MOSCOW

On an early spring afternoon slightly less than three months after taking over Russian aerospace behemoth United Aircraft (UAC), Yuri Slyusar enters a conference room of a Soviet-style, beige concrete structure in central Moscow.

Slyusar, the former deputy minister of industry and trade for aviation, is already an hour late for a one-hour interview. As he sits down, he speaks in clipped Russian to his translator, who politely relays a request:

“Mr. Slyusar asks if the interview can be shortened to 30 minutes,” the translator says.

Your correspondent was hardly in a position to object. Slyusar is the new manager of a sprawling, state-owned corporation facing a host of economic and strategic challenges.

He is a rather busy man.

Since officially taking over UAC on 19 January, Slyusar has bounced from issue to issue. A depreciating rouble has driven up the cost of imported systems from suppliers,

while Western sanctions are threatening Russian access to a globalised supply chain and customer base. Meanwhile, crushing debt has been jeopardising the stability of UAC's premier commercial aircraft programme – the Sukhoi Superjet.

HOMEGROWN TECHNOLOGY

On top of these considerable external pressures there are new domestic forces. For the past 15 years, UAC had championed collaboration and partnership with Western suppliers, which now provide many of the engines, avionics and other systems for the Superjet and Irkut MC-21.

But Slyusar is open to calls from Russian government industry sources to integrate more homegrown and sanction-free Russian technology, while also turning east to cultivate even closer ties to aerospace industries in China and India.

With so many raging issues swirling around the company, achieving stability seems to be Slyusar's focus so far. Asked if

As the new head of state-owned UAC, Yuri Slyusar is grappling with a global outlook quite unlike what his predecessors were anticipating just five years ago



his new leadership means an in-house restructuring is likely to come soon, he offers a quick reply.

“It's unlucky to seek big changes right now,” Slyusar says.

It is as if the Russian aerospace industry was in a different universe five years ago. The Superjet was completing certification testing, the MC-21 had just been launched and Western companies were largely free to share technologies with Russian commercial aviation programmes. That was also the year that UAC unveiled two strategic goals: to capture 3% of the commercial aircraft market and nearly 10% of the military aircraft market by 2025.

The industrial and geopolitical landscape is now almost unrecognisable from those times, but UAC's new chief executive sounds

“The economic turmoil has led us to promise the board a sort of anti-crisis programme”

YURI SLYUSAR

Chief executive, United Aircraft



UAC sees the Superjet programme as critical to its credibility in the commercial market



Tier 1 level of the Russian aerospace supply chain. Industry consolidation in the USA and Western Europe has formed a large collection of Tier 1 suppliers, a sophisticated class of the supply chain characterised by the ability to design and assemble complex, integrated systems, such as onboard power and computing systems. Rostec has been cultivating companies such as KRET and Technodynamics to perform similar roles. It is

“The rouble deterioration gave a big chance to domestic manufacturers and suppliers”

YURI SLYUSAR

Chief executive, United Aircraft

still early days, but Western sanctions have pushed Russian officials to call for accelerating a transition to local suppliers on commercial programmes.

Russian industry has long been self-sufficient with military systems technologies, but UAC's market share objectives for commercial aircraft requires an industry that can reliably produce systems that can pass Western certification standards.

SYSTEMS INTEGRATORS

“The recent rouble deterioration and the currency fluctuations gave a big chance to domestic manufacturers and suppliers to switch some of the existing international suppliers, both in the process of Superjet modernisation and MC-21 development,” Slyusar says.

“Bearing in mind, they should be the same quality, the same certification and the same price – maybe even better – then this is a real opportunity for Russian suppliers to step in and to change the Western ones. Although the rouble right now is rising, so this effect may be a little bit smaller.”

The Russians have already launched the Aviadvigatel PD-14 turbofan engine to compete with the Pratt & Whitney PW1400G geared turbofan. Now, companies such as Technodynamics are seeking to become Russia's answer to the USA's UTC Aerospace Systems or Europe's Thales – Tier 1 systems integrators. As Slyusar notes, however, the near-term objectives for Russian participation in the MC-21 are more modest.

“It's electrical systems, chassis [wiring harnesses] and the air conditioning system, and they are right now on the stage of final development. They would probably start soon the testing and development of these systems maybe using our flying laboratories and aircraft,” Slyusar says.

“Pretty soon they will be ready to step in, to ship these systems for our aircraft. It concerns both the Superjet and MC-21 programmes.” ■

practical as he recommitments to achieving the market share goals.

“Basically, these figures are still workable,” he says.

CRISIS RESPONSE

First, however, Slyusar's goal is to stabilise the company's finances and rescue the Superjet – a programme viewed internally as essential to building UAC's credibility with the commercial market as Irkut prepares to begin delivering the MC-21 in less than three years.

“The latest economic turmoil has led us to promise the board of directors to develop sort of an anti-crisis programme to increase effectiveness and to cope with the recent economic conditions,” Slyusar says.

UAC is keeping many details of the crisis response plan closely to its chest for now – but it includes a deal struck in early April that has committed the Russian government to invest a further 100 billion roubles (roughly \$1.8 billion) to stabilise the finances of the Superjet programme.

More ambitious changes also could be pur-

sued. The Russian aerospace industry is dominated by two conglomerates – UAC and Rostec. Both companies have aggregated dozens of former Soviet design bureaux and factory complexes. While UAC is a corporate umbrella for Russia's fixed-wing aircraft makers, Rostec oversees a vast empire that includes United Engines, Russian Helicopters and electronics and systems specialists such as KRET (“Radioelectronics Technologies Concern”) and Technodynamics. Rostec has already moved aggressively to slash costs, announcing plans to lay off 40,000 engineers.

UAC is not quite ready to announce specific cost-reduction plans, but Slyusar acknowledges some budget-cutting will be necessary.

“Of course, we'll be probably moving in the same direction,” he says. “Some management will be cut. There will be optimisation of costs of course, maybe some corporate optimisations and restructuring. Of course, all these things should be done. Right now we're not ready to speak about exact figures of any changes that are being prepared at the moment.”

Another major shift may occur below the

GRAND PLANS

Sukhoi's Su-35S is a victim of Russian budget cuts, with procurement halved



Russia's defence industry is pursuing modernisation and gap-filling initiatives amid challenging fiscal weakening

STEPHEN TRIMBLE MOSCOW

Asking questions about next-generation bombers and unmanned air vehicle projects in Russia's defence industry leads to quick – albeit unhelpful – responses in on-the-record interviews.

"Let's keep [that topic] for the future," says Yuri Slyusar, the newly appointed chief executive of United Aircraft (UAC).

But there is no doubt that the Russian government and industry is working to address such curious gaps in the portfolio. The Russian air force is virtually alone among air forces of its size to have not procured or developed a large, weapons-capable unmanned air system. MiG rolled out a demonstrator aircraft called Skat at the MAKS air show in 2007, but nothing has been heard of the project since. UAC, meanwhile, has reported receiving a contract to develop a next-generation bomber, which has been assigned to Tupolev.

CATCHING UP

With those projects ongoing behind the scenes, the aviation branch of Russia's military has had a lot of catching up to do. The atrophy of the post-Cold War years was exposed in the brief conflict with Georgia in 2008, leading to the release of an arms modernisation plan unveiled in the State Armaments Plan for 2010-2020.

That sweeping document laid out plans to

buy as many as 441 fighters, 250 airlifters, more than 1,100 helicopters and 80 jet trainers, and modernise the air force's jet-powered bombers, heavy lift transports and MiG-31s.

The scope and breadth of Russia's shopping list raised questions about the defence industry's ability to support it, but Slyusar says it is keeping up with the requirements so far, even as military aircraft deliveries ramp up to near Cold War levels at above 100 units a year.

"We don't see a problem with these numbers. When the programme will be updated and finalised, we are ready to turn out the necessary numbers of 120-130 aircraft per year," Slyusar says.

Of course, the government is providing the industry some relief from the demands imposed by the 2010 document.



PAK FA has been a recent modernisation focus

The cornerstone of Russian fighter jet modernisation since 2010 is the PAK FA (an acronym translated as "future aviation project for front line aviation"). The first Sukhoi prototype T-50 flew on 29 January 2010, shortly before the Russian government unveiled a plan to procure 70 operational PAK FA aircraft by 2020.

But several incidents in flight testing, including two publicised engine failures, and Russia's deteriorating economy have slowed development and slashed procurement plans. The state armaments programme (SAP) for 2015-2020 unveiled last year trimmed T-50 procurement to 55 aircraft over the five-year period. But that was before a currency crisis altered Moscow's budget priorities. By last March, the number was further reduced to only 12 aircraft through 2020, according to Russian media reports quoting deputy defence minister for armaments Yuri Borisov.

ONLY POSTPONEMENT

Slyusar notes that the reduction in the five-year programme only postpones the aircraft purchases, rather than eliminates them.

"It's not a decrease. It's been postponed. The development cycle is still ongoing and there's a little push to the right side of the whole programme. It's not cut in numbers and we also hope that our co-operation with India would support this project," Slyusar says.

However, PAK FA is not the only fighter programme suffering from Russia's fiscal weakening. The 2010 SAP revealed a plan to buy 96 super-maneuvrable Sukhoi Su-35S fighters, but that number was halved in the 2015 budget. By

"We are ready to turn out the necessary numbers of 120-130 aircraft per year"

YURI SLYUSAR

Chief executive, United Aircraft

contrast, the tried-and-proven Su-30M is a beneficiary of leaner times. Its procurement allocation doubled between 2010 and 2015 to 60 fighters. Still unscathed is a plan to buy 48 MiG-35s, but a contract is not expected until 2016.

The Russian bomber fleet has encountered more stability in the procurement plan. The numbers of modernised Tupolev Tu-160s and Tu-95s in the long-term acquisition plan are unchanged. But reports of development delays of the PAK DA have confused the picture. Russian air force officials have recently unveiled a plan to revive Tu-160 production after more than 20 years. How this could further drain the classified PAK DA budget is not clear.

As modernisation of the current Tu-160 fleet continues, the government also reportedly now intends to re-start production of the famous "White Swan" bomber starting in 2023. ■

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The Ka-52 has proven a strong seller for Russian Helicopters

HEAVY MATTERS

Russian Helicopters – a strong presence locally and across the world – faces an engine dilemma due to the Ukraine crisis, and questions over its strategy in the light market

VLADIMIR KARNOZOV MOSCOW

Russian Helicopters is a strong, viable rotorcraft manufacturer with a firm footing in the domestic and overseas markets. But its future prospects are darkened by events unfolding in neighbouring Ukraine, the company's longtime majority supplier of turboshaft engines.

There is little doubt that, in the long run, Russia can find alternative sources of engines or develop a local manufacturing capability. But in the interim, the engines may be in short supply, hitting sales and deliveries. On the positive side, the company has recently won new big deals in China and India which further strengthen the manufacturer's footprint

in these important client countries, whose demand will continue to drive business.

By the total number of shipments in 2014, Russian Helicopters, with 271, is second only to Airbus Helicopters, with 471. However, as the company admits, it delivered eight different types to clients from 11 countries last year – hardly reflective of a broad customer base outside of its home country.

CHEAPER OPTION

Despite a substantial rise in list prices over the past few years, Russian platforms are still cheaper to buy. This, of course, means that revenues at the manufacturer are lower than those of its Western rivals. Besides, with the concern only recently turning its attentions

to generating income from after-sales support, a certain lag behind the big four of AgustaWestland, Airbus Helicopters, Bell and Sikorsky is understandable.

Geographically, Russian helicopters are well represented throughout the world. At the same time, their presence is somewhat one-sided: most in-service Russian rotorcraft fall into the heavy class, with maximum take-off weights (MTOW) of 11-16t. Almost all popular models from the Mil and Kamov design houses – including combat, utility, transport, VIP, naval – fall into this rather narrow niche.

And Mil holds the honour of making the world's largest helicopter, the 56t Mi-26T, which will shortly be produced in an updated T2 guise.

Below 11t, however, Russian Helicopters' presence is almost non-existent. This is certainly a weak point and one that the company is attempting to address with a three-pronged assault on the medium-weight class.

This consists of the serially delayed 6.5t Ka-62 (and its military version, the Ka-60), the 3.6t Ansat and the Ka-226. Seating up to 11 passengers, the Ansat, available for the civil market with a hydro-mechanical control system, rather than fly-by-wire controls as originally intended, is meant to replace the nine-seat Mi-2. Although designed in Moscow, nearly 5,500 copies of the Mi-2 were produced in Poland, including some that are still operational. The Ka-226T, certified in March this year, features Kamov's characteristic co-

"It is not easy to start work on indigenous lightweight helicopters in earnest"

ALEXANDER MIKHEYEV

General manager, Russian Helicopters

axial rotor layout and detachable cabin modules. This helicopter is more suitable for hot-and-high operations in urban and mountain areas. India, having selected the platform for its light scout requirement, is negotiating terms covering local assembly, with a forecast production run of between 200 and 500.

And yet, the future of Russian involvement in this market segment is far from assured. Competition from the West is very strong, with most European and US manufacturers having cultivated their presence for decades.

LACK OF LIGHT

Russia is entirely absent in the big market segment of light helicopters. Apart from a handful of 1.5t Mi-34s, of which fewer than 30 were built in the 1988-2011 timeframe, there is no Russian presence there. Kamov tried its luck with the 2t Ka-112, and Kazan Helicopters with the 1.2t Aktai, but these did not proceed beyond prototypes. The primary reason has been the very strong competition from US and European manufacturers, which – unlike Russians – have always been paying attention to this sector.

"It is not easy for us to commence work on indigenous lightweight helicopters in earnest because the Mil and Kamov design houses are now overloaded with other work. Instead, we need to turn our Western rivals into partners," says Alexander Mikheyev, general manager at Russian Helicopters. "So, in the domain of lightweight helicopters we focus on partnerships with global manufacturers which are already well represented in this market niche".



A Chinese People's Liberation Army Air Force Mi-171E

Russian Helicopters

The Mi-26's maximum take-off weight of 56t gives it a maximum payload of 20t. It can take 82 armed soldiers or up to 60 wounded. Over 300 Mi-26s have been manufactured so far, including about 40 for export customers. The latest deliveries were to the Russian defence ministry: 17 machines in 2011-2014. In addition to three Mi-26TS received in 2007-2010, China ordered one more for delivery this year.

In the meantime, the manufacturing plant – Rostvertol in Rostov-on-Don – has been working on making the Mi-26T2 a new production standard. It features a state-of-the-art BREO-26 avionics package from Russian firm KRET allowing for night operations, with a glass cockpit based on five LCD screens, digital data processing, satellite-aided navigation, secure datalink and built-in health-monitoring system. The number of crew is reduced from four to two (from five to three in case of using a sling). The new avionics and improved control system enables the helicopter

to execute precise manoeuvres when hovering with an underslung load.

The Russian defence ministry is the primary customer, but the exact number of orders is not yet public. The first foreign customer is Algeria, which signed for six units in July 2013. This move had been preceded by a demonstration flight programme in the country using MSN901, a prototype first flown in 2011.

NEARING DELIVERY

Rostvertol assembled two deliverable Mi-26T2s in 2014, both painted in "desert" colours, rather than standard Russian grey or green livery. The first entered flight tests in late December, and is now being prepared for delivery.

After no less than five years of negotiations and product definition talks, China and Russia have struck a deal to jointly develop the Advanced Heavy Lift (AHL) helicopter. In the presence of Chinese premier Xi Jinping and Russian president Vladimir Putin, the respective agreement was signed on 8 May.

Executive director and chairman of the Board at AVIC, Lin Zuoming, who applied his signature to the agreement, says: "Russian Helicopters has unique competence in heavy rotorcraft. For instance, the performance of the legendary Mi-26 series helicopters is unmatched. These reliable machines have helped us on a few occasions. The Mi-26TS played an important role in disaster relief operations following strong earth shakes in Sichuan province of China in 2008 and 2013. I am convinced that the co-operation with Russian Helicopters on the new heavy helicopter will be productive and will greatly influence in a positive way the further development of the Chinese helicopter industry."

The AHL is intended have a MTOW of 38t, and maximum internal payload capability of 10t and up to 15t on a sling. This makes it no competitor to the heavier Mi-26T2, but rather a



Rex Features

Updated for a new generation, the Mi-26T2 is an improved version of the 56t heavy-lifter

» successor to the Mi-6 with a MTOW of 42.5t and payload capability of 8-12t, of which 926 examples were built and which stayed in operation from 1963 to 2004. Its derivative Mi-10K survives, but a handful of those “flying cranes” suffer from a shortage of tail rotors made of chemically-reinforced wood.

WIDE SPECTRUM

According to Russian Helicopters, the 8 May agreement allows for the design work on the new machine to start in earnest, and for production preparations to commence. Among a mutually-agreed set of requirements for the new rotorcraft are an ability to operate around-the-clock in a hot-and-high environment, and in all weathers. “The AHL shall be able to serve in a wide spectrum of roles, including transportation, evacuation, fire-fighting,” Russian Helicopters says. It is meant to be produced in China, and win “over 200 orders” with shipments through to 2040.

Even though the partners picture the project as being civilian, it is hard to believe that People’s Liberation Army would not also sign up.

Mikheyev, who applied his signature to the 8 May documents, says: “The Chinese helicopter market is one of the fastest growing ones in the world. We are interested in long-term, comprehensive relations of a strategic nature with China for the sake of mutually beneficial co-operation in the field of helicopter development and production.

“It is very important that the resulting heavy helicopter has gained approval from the side of governments of our both countries.”

On the opening day of the HeliRussia show in May, Mikheyev told the media that Russian Helicopters and AVIC have formed preliminary technical requirements, and “continue to



The medium multirole Mi-171A2 was first seen at MAKS 2013

Russian Helicopters

work jointly on defining technical parameters” of their new product. The two are set to sign a general contract on the project later this year. There is a mutually-agreed “roadmap” for further actions. Mikheyev says: “Participants have been named, among them Russian and Chinese companies, as well as Ukraine’s Motor Sich with an engine.” However, Ukrainian officials were quick to deny Motor Sich the right to take part in this project.

Meanwhile, Russia’s Aviadvigatel design house signalled its intent to develop a brand-new engine for the helicopter. It would use the gas-generator developed for the PD-14, a 14t-class turboprop now undergoing bench trials, and destined for the Irkut MC-21 next-generation narrowbody airliner. The new engine is known as the PD-12V.

The lion’s share of Russian Helicopters’ sales are of medium rotorcraft: the Mi-24/35, Mi-28 and Ka-50/52 for the army, the Ka-27/28/31 for the navy, the Ka-32 for fire-fighters and timber-

loggers, and the Mi-8/17 family for a wide variety of military and civilian applications.

The Mi-8/17 family has accounted for more than half of shipments in the past several years, at some 150-200 units annually.

An important achievement for Kamov designs in the civil domain has been a framework contract with China for 20 Ka-32A11BCs, with four shipments in 2014.

The 12t Mi-8, which first flew in 1961 and entered service four years later, and boasts the world’s most mass-produced twin-engined, turbine-powered helicopter with over 12,000 copies, is still economically attractive.

LOCAL DEMAND

According to Angara, a prominent commercial operator of Eastern Siberia with 13 Mi-8s, these TV-2-117-powered machines are popular with local customers, including tourist operators and oil and gas companies.

Even though the Mi-8T is considered “under-powered” by modern standards, in the Siberian environment it provides the least expensive means of transportation for a group of 15-20 people with their weekly supplies, such as a shift of workers for an oil derrick or a drilling rig.

Angara also operates a pair of Mi-8MTVs with high-power TV3-117s (2,000-2,200shp compared to 1,500shp for the TV2-117), but finds their services more difficult to sell, as the market is used to the cheap but capable Mi-8T.

“We have been looking for a suitable replacement for the long-serving Mi-8, but the list-prices for Russian Helicopters’ newly-built rotorcraft are too high. The factory in Ulan-Ude produces a superb Mi-171, but because of the high price, its flight hour comes with a tariff which our clients are not yet ready to accept”, says Angara director Anatoly Yurtaev.

Meanwhile, there are many other markets in the world where the Mi-17’s services are in demand. According to Atlas Taxi Aereo, in the Brazilian environment the Mi-171A1 demonstrates four times higher productivity than the Sikorsky S-76A. ■



Russian Helicopters

India has selected the Ka-226T light scout, with local assembly being negotiated

From yuckspeak to tales of yore, send your offcuts to murdo.morrison@flightglobal.com

Back-seat read

Thanks to Paul Heasman for sending a thumbs-up from the chaps at the Royal Air Force's Valley base after reading our cover feature about the Hawk T2s flown by its 4 Sqn training unit (*Flight International*, 21-27 July). There's clearly quite a queue to get hold of a copy.

Our fee for the stunning cover and feature images went to 4 Sqn's chosen charity – the Ty Gobaith Children's Hospice. To make a donation, visit justgiving.com/HawkT2RoleDemo

US Air farce

For a brief, gleeful moment we thought the US Air Force had a funny side. But apparently it doesn't. On 5 August, it posted a "tech report" video on YouTube about its secretive, Boeing-built X-37B Orbital Test Vehicle, but the clip was quickly pulled. Too risqué, apparently.

In the video, the narrator dares to ask: "What is the X-37B doing in space? Is it a space bomber? Is it a surveillance sensor? Is it tampering with other satellites?" As we think we're about to find out, the narration is bleeped and "Top Secret" is stamped across the screen. It was a witty ruse, and a call for people to speculate about the space plane's odd mission in the comment section.

We can only presume some top general somewhere in the bowels of the Pentagon didn't see the humour and killed it –



Don't goddam humo(u)r me!



"Nice formation-reading, Hoskins"

perhaps because the narrator's suggestions were too accurate? We might not know exactly what X-37B is doing in space, but we now know for sure the air force has lost its sense of humour.

Tanker rancour

Losing the US tanker contest clearly still smarts for Tom Enders. At the recent Airbus Group results, the chief executive and former paratrooper noted that the A330 MRTT has won every competition in which it has taken part in the past 10 years, with the exception of the US programme.

"It is the most capable and most efficient tanker aircraft," he noted, adding dryly: "And by the way, the US Air Force would admit that behind closed doors I'm sure."

Waterbird return

We are used to invitations advising us on dress code: black tie/uniform, business suit and the favourite of our American cousins, smart casual (dinner jacket and swimming trunks?).

However, those attending next month's re-enactment of the 1911 Waterbird flight over Windermere in the Lake District are implored to don "Edwardian dress and practical footwear". Capt Edward Wakefield's origi-

nal Waterbird was the first aircraft to take off from and land on water, outside France or the USA. The flight of the replica on 17 September by The Lakes Flying Company is designed to commemorate Wakefield's contribution to aviation.

Admiral of the Fleet Sir Benjamin Bathurst and John Gordon, great grandson of the pioneering airman, will attend. We wish the project well.

Psychic news

And finally, this week's Crystal Ball Award goes to a certain US aviation fortnightly which promises potential readers in a promotional email "upcoming award-winning editorial".

According to HL Mencken, "a journalist should never say what is going to happen..."



Here are tomorrow's headlines...

Nerves of steel

When one considers the nature of flights over hostile territory, be they reconnaissance, range-finding, or bomb-dropping expeditions, subject all the while to the liveliest fire from anti-aircraft guns, it seems a marvel that pilots, and observers too, do not suffer nervous breakdown.

100 YEARS AGO

Ready for a pint?

The Germans are believed to have put 500 aircraft into the air in the day. Southampton was no easy victim. One Spitfire

75 YEARS AGO

squadron bagged nine Ju. 87 dive-bombers and four Me. 109s. The city did not escape unscathed. Eight public houses were damaged, but in one only the windows were broken and the 400 drinking glasses escaped.

The new standard

There is concern about the concerted programme of arms sales run by the US Department of Defense, whose declared

50 YEARS AGO

objectives can be summed up as "standardize free world weapons by buying American".

Over the rainbow

Rainbowing, an optical problem associated with laminated windshields, first became evident in 1976 as pilots flying F-111s began complaining of seeing colours on their windshields. Now the US Air Force has developed a portable transparency optical test system (P-TOTS).

25 YEARS AGO

100-YEAR ARCHIVE

Every issue of *Flight* from 1909 onwards can be viewed online at flightglobal.com/archive

France will take the spotlight as “feature country” at Singapore

Singapore Airshow 2016 will welcome France as the Feature Country in the fifth edition of the show, scheduled to take place from 16 to 21 February 2016, at the Changi Exhibition Centre.

The Feature Country series, which made its debut at the 2014 Airshow, was developed as a permanent feature to enable the companies exhibiting within the pavilion to leverage on the Singapore Airshow as a strategic platform; lending support to businesses of the Feature Country and enabling them to tap the opportunities in the Asia Pacific region and beyond.

The French Pavilion will be located at a prominent spot within the exhibition hall. Participating exhibitors will have access to a dedicated “Deminar” area – a demonstration and seminar area for research institutes and universities to showcase their latest technologies and innovations. In addition, business meetings between the French Pavilion exhibitors and VIP delegations will also be specially facilitated.

“Being a Feature Country at the Singapore Airshow 2016 gives us the unique platform to bring together our latest and best aviation technologies to meet the growing appetite for innovation in the Asia Pacific aviation sector, translating into real business deals for our French companies,” said Emeric D’Arcimoles, the Paris Air Show Chairman and Chairman of the



International Committee of Groupement des industries françaises aéronautiques et spatiales.

The French aerospace, defence and security industry is worth 47.9 billion Euros, and specifically, out of which 30.4 billion Euros is contributed by exports. This shows that France is well-placed to leverage its Feature Country platform to bring its latest innovations to the region's top decision-makers converging at Singapore Airshow 2016.

This comes at an opportune time in the Asia Pacific aviation industry, where the com-



mercial aerospace sector is expected to set new records for aircraft production in 2015, off the back of the accelerated replacement cycle of obsolete aircraft and growing passenger travel demand in the Asia Pacific region. Countries in the region are also increasing defence spending to equip their militaries with modern defence platforms and technologies.

Reflecting this growth is the continued expansion of reach and impact of each new edition of Singapore Airshow. The 2016 show is already 80 per cent committed, with specialised spaces like the Aerospace Emerging Technologies Zone, the Training and Simulation Zone and the introduction of the Business Aviation Zone, to further spawn business development opportunities.

For more information about the Feature Country programme, please contact Mr Danny Soong at dannysoong@experiaevents.com or +65 6595 6123.

Hosted Buyers Programme offers new partnership opportunities

Buyers seeking specific products and solutions at Singapore Airshow 2016 can now leverage on the Hosted Buyers business matching programme to source



new contacts and explore new ventures. Accorded with a complimentary 4-day Hosted Buyer Pass and exclusive hospitality arrangements during the trade days, each eligible buyer will enjoy a hassle-free business meeting experience as pre-scheduled meetings are facilitated with exhibitors that match their requirements.

For more information about the Hosted Buyers Programme, please contact Ms Liliane Lye at lilianelye@experiaevents.com or +65 6595 6126.

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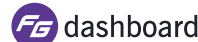
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Flight Safety Symposium

London, UK

flightglobalevents.com/

flightsafety Symposium2015

15-18 September

DSEI 2015

ExCel, London, UK

dsei.co.uk



29-30 September

Aviation Partnership Summit

Amsterdam, The Netherlands

flightglobalevents.com/APS15



29-30 September

New Generation of Airline

Passenger Systems

London, UK

flightglobalevents.com/pss2015

1 October

US Corporate Aviation Summit

Fort Lauderdale, Florida

aeropodium.com/uscas

1-2 October

Central Asian Aviation Symposium

Almaty, Kazakhstan

aeropodium.com/caa

6-8 October

Helitech International

ExCel, London, UK

helitechevents.com

14-15 October

Aerospace Innovation Forum

Palais des Congrès, Bordeaux, France

www.aerospace-innovation-forum.com

20-21 October

The Commercial UAV Show

ExCel, London, UK

terrapinn.com/exhibition/

the-commercial-uav-show

8-12 November

Dubai Airshow

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15-17 November

ALTA Airline Leaders Forum

San Juan, Puerto Rico

alta.aero/airlineleaders/2015

17-19 November

NBAA 2015

Las Vegas, USA

nbaa.org/events/bace/2015

17-19 November

Aerospace & Defense Meetings Torino

Torino, Italy

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19-20 November

Safety In African Aviation

Kigali, Rwanda






FLIGHT SAFETY SYMPOSIUM 2015

Park Inn by Radisson, London Heathrow, UK
15th – 16th September 2015

KEY INDUSTRY SPEAKERS INCLUDE








Commercial Flight Safety

-  **Paul Calitis**
Senior VP Flight Operations
AirBaltic
-  **Mike Anderson**
Senior Director of Safety
Spirit Airlines
-  **Martin Timmons**, Deputy Director of Safety & Security / Safety Manager,
Ryanair
-  **Gerhard Coetzee**, Senior Vice President Corporate Safety and Quality Assurance,
Air Astana
-  **Robin Zammit**
Head of Safety & Compliance
Air Malta








Safety in Air Traffic Control

-  **Alec Trevett**
Senior Technical Advisor
CAA
-  **Neil May**
Head of Human Factors
NATS
-  **Steven Shorrock**, Safety Culture Program Leader
Eurocontrol
-  **Alfred Vlasek**, Head of Safety and Occurrence Investigation
Austrocontrol
-  **Philip Church**
Principal Consultant
Helios



Airline Engineering & Maintenance Safety

-  **Sir Timo Anderson**, Consultant Principal, **Charlesworth Associates Ltd**
-  **Jorge Leite**, VP Quality and Safety - M&E Safety Manager
TAP Maintenance & Engineering
-  **John DeGiovanni**, Managing Director – Safety, **United Airlines**
-  **Stephen Hoy**, Operations Quality Manager, **Nordam**
-  **Chris Parsons**, Lead Air Safety Consultant, **Atkins**

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
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• Improving your Safety Management Systems (SMS)
• Building up commitment from senior management to enhance safety in your organisation



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• SESAR as an enabler
• Remote Towers: what are the real risks?
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AIRLINE ENGINEERING AND MAINTENANCE SAFETY 2015
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• Integrating and embedding Safety Management Systems (SMS) across the enterprise
• Getting the right message out of all of the data
• Understanding and testing the effectiveness of implementing a 'Just Culture'

EXPERT SPEAKER LINE UP INCLUDES:

Jorge Leite
VP Quality and Safety - M&E Safety Manager
TAP Maintenance & Engineering

John DeGiovanni
Managing Director - Safety
United Airlines

Philip Zammit
Head of Safety & Compliance
Air Malta

Paul Calitis
Senior VP Flight Operations
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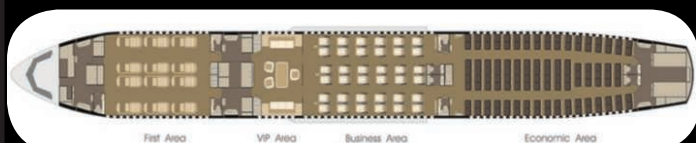
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- Civil or Military aviation management is an advantage
- Fluency in writing and spoken English is required
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- Willingness and aptitude to work in a multi-disciplinary and multi-cultural environment

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- Minimum experience of 5 years in development of procedures and processes for aviation technical operations
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- Well-developed communication, interpersonal and presentation skills
- Willingness and aptitude to work in a multi-disciplinary and multi-cultural environment

Job title: Data Analyst

Qualifications, Experience and Skills

- Computer proficiency in the use of word processing/desktop publishing spread sheet and graphic presentations.
- Proficient in English language. Any other language including Arabic would be an advantage
- Ability to collect, collate safety data for the establishment of a common database and conduct risk assessment in the determinations of trends and establishment of alert levels.
- At least 5 years of experience as data analyst.
- Well-developed communication, interpersonal and presentation skills
- Willingness and aptitude to work in a multi-disciplinary and multi-cultural environment

Job title: Environment Officer

Qualifications, Experience and Skills

- Minimum of 3 years working in the aviation sector, preferably within a Civil Aviation Authority or Airline.
- Minimum of 5 years dealing with environmental issues.
- Minimum of an under-graduate level qualification in an environmental or sustainable development subject
- Good understanding of aviation regulatory affairs and the working processes of ICAO and Civil Aviation Authorities.
- General understanding of sustainable aviation issues, including sustainable aviation fuels, industry climate change targets, CAEP policy frameworks
- Sound knowledge of related ICAO annexes, recommended practices
- A well-rounded individual with the ability to engage a wide range of senior aviation stakeholders at national, regional and international level.
- Experience in policy development, analytical and project management skills.
- Fluency in written and spoken English is required

The deadline to supply your C.V is September 1st 2015

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WORK EXPERIENCE BENJAMIN TICHANÉ

Developing new links in the chain

Benjamin Tichané has a lifelong interest in aircraft. He started his career in aerostructures as a production manager of 787 doors, and now manages Gardner Aerospace's business unit in Mazères, southwest France

Have you always been interested in aviation?

Growing up I wanted to be a pilot, but I became more interested in the manufacturing side of the aviation industry when I started studying for my degree in engineering. I was drawn by the possibilities in the aerospace sector and how quickly things were moving forward – I just wanted to be a part of it.

What was your experience before the current job?

Before joining Gardner in 2014, I worked for one of our current customers, Latécoère, for nine years, starting as a production manager for Boeing 787 doors, then a procurement manager and finally a supply chain manager for all aerostructures. Gardner hired me as a supply chain director for Gardner France, and six months later I took the position of core business unit director.

What does your job entail?

There are two business units in the Gardner Mazères facility: one for the Airbus A350 and A330neo programmes, and one for the core programmes. I am in charge of this second business unit, so my day-to-day duty is to manage the operations across a business unit of nearly 200 people. Currently, we have core serial programmes running for five key customers, so most of my day is spent co-ordinating these across the different departments, from the sheet metal shop floor to the supply chain to quality checks. I try to take myself away from current projects for a few



Tichané has always marvelled at the technical achievements of aviation

hours a day, so I can focus on the development of the site and make time to speak to our current customers and any potential new customers.

What are the most challenging aspects of your job?

The most challenging aspect of serial production is hitting your production targets month after month, when faced with situations that slow down or sometimes halt production. It can be quite stressful trying to find a solution quickly, but being able to adapt in this fast-moving sector is essential for business survival so I like to think we take these challenges in our stride and tackle them as a team. The silver lining is that these challenges definitely add variety to my job.

What do you enjoy most?

My job represents a lifelong interest in aircraft, so there is very little I don't enjoy about it. It is great to work in an industry I am so passionate about and that is the main economic driver for my hometown, Toulouse. I enjoy working with my brilliant team every day, building the parts for a beautiful and technical product – a product that I have marvelled at from a very young age.

You operate in a competitive marketplace. How does Gardner stay ahead of the game?

I believe Gardner stays ahead of competitors by listening to customers and reinvesting income across the group to improve facilities and service. When Gardner recognised that customers want fewer but stronger and more

global suppliers, we set about consolidating the fragmented detailed parts industry by expanding our offering and entering new locations. This expansion in low-cost locations meant lower overhead and production costs. Now we are competitively priced, while still offering group-wide consistency in quality and service. Also, each of our sites is an excellence centre for one or more technologies needed for aerostructures.

What's next for the company?

We have been building our relationship with Airbus for years, so the future as a first-class supplier looks promising. However, we cannot be too reliant on a single source of opportunities so we are also focusing on new business over the next five years. Following a successful expansion programme abroad in India and Poland, we are also focusing on developing our operations in the UK.

What's next for you?

As I have only been at Gardner for 18 months I aim to keep hitting my targets, attracting new business and developing the Mazères site. ■



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